THE

ELECTRICAL REVIEW.

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CONTENTS:

	PAGE
Model General Conditions	709
Parliamentary	711
Legal	717
Correspondence:—	
Consulting Engineering as a Profession	718
Tramway Linesmen's Duties	718
Electric Wiring Methods of To-day, with Special Reference to Conduit Systems	718
Reason Manufacturing Company, Limited, *v.* Ernest F. Moy, Limited	718
Much Ado about Nothing	719
An Explanation	719
Business Notes	719
The Karlsruhe Electricity Works (*illustrated*)	729
The Berlin Overhead and Underground Electric Railway (*illustrated*) (*concluded*)	731
Supply Station Accounts	735
City Notes	736
Traffic Receipts	740
Stocks and Shares	740
Share List of Electrical Companies	741
Market Quotations	742
Current Specifications.—C.	743
Physical Society	743
The L.C.C. and Tube Railway Bills	743
Institution of Electrical Engineers:—	
Air-Spaced Cables: Their Treatment and Use	744
Tests on the Nernst Lamp (*concluded*)	745
The Wolverhampton Exhibition	747
London's Rapid Transit Schemes	750
Electro-Magnetic Oscillations.—II. (*illustrated*)	750
A New Type of Continuous Current Arc Lamp (*illustrated*) ...	751
New Patents	752

THE

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MODEL GENERAL CONDITIONS.

IT need hardly be said that we heartily welcome any attempt to standardise and equalise the conditions under which electrical contracts are carried out.

Our columns have during the past two years pointed out a few of the anomalies existing in specifications for plant to which electrical manufacturing firms have, by public advertisement, been invited to tender. These stipulations have in many cases been flagrantly unjust, in others perfectly ludicrous. Only those of our readers whose business brings them into close contact with the requirements of possible buyers and their representatives have any real idea as to the detrimental effect which this archaic method of procedure has upon our commercial prosperity. It may be amusing for the purchaser of an article costing possibly 30s. to send with his inquiry a long printed document, demanding from the seller a promise to pay a penalty of £6 a week if late, but it is not business. The same may be said of a number of other demands constantly to be met with in specifications sent to electrical manufacturers.

It is said that the contract for the purchase of one of our largest Atlantic liners was contained on one sheet of note-paper; how different it often is with the sale of a few small items of electrical goods!

It would be an interesting study, but one productive we fear of little good, to examine the influence of the personal element in the evolution of the modern specification. It is enough for our present purpose to take them as they come, each differing in phrase if not in substance, and each demanding careful examination before the signature of the tenderer is attached to the form binding him to obey all its stipulations and agree to all its provisions.

The present is not, however, by any means the first attempt to evolve some form of order out of chaos. In other industries, as Mr. Hammond reminded the members of the Institution of Electrical Engineers when introducing the subject to their notice, steps have been taken which have secured practical uniformity in procedure. In our own profession four years ago, a Joint Committee appointed by the Municipal Electrical Association as representing purchasers, and the Electrical Plant Manufacturers' Association acting for contractors, carefully considered the matter, and in February, 1898, issued a number of draft clauses, which they recommended should be accepted as standard, and incorporated in electrical plant contracts. To a large extent this proposal failed because the persons principally concerned in drafting specifications, viz., the consulting engineers, were not sufficiently represented on the Committee.

At a later period an attempt has been made by means of agreement between the members of one section of the industry, viz., the cable makers, to improve matters by refusing to accept other than mutually agreed-upon clauses, but this has not resulted in securing that uniformity in practice which is eminently desirable.

D

Mr. Hammond, who has for many years treated the drafting of contract general conditions as a fine art, deserves the thanks of the electrical community for having urged upon the Council of the Institution of Electrical Engineers the claims of their duty in this matter. At his suggestion, in December, 1900, a Committee was formed to prepare a draft set of "model" clauses for adoption as "standard" by the entire industry. This Committee, wisely, in our opinion, obtained the co-operation of representatives of the Municipal Electrical Association, the Electrical Plant Manufacturers' Association, the Cable Makers' Association, and the Engineering Employers' Federation, so that the result of their labours may be taken as in the main acceptable to all parties. We think it would have been politic to have also invited a representative of the Trades Unions to have joined their deliberations, since it would have helped to create the feeling amongst the workers in our manufactories that they were in a sense parties to the liabilities of their employers for the due performance of their contracts.

We do not know whether it was the opinion of the Council that the present proposals were so near perfection that they could be discussed and finally adopted as part of one evening's programme. It was, however, clearly evident at the meeting of the Institution that the members rightly appreciate the important influence these clauses may exert upon the future of the industry, and desire that they may be fully and frankly discussed. We hope that the facilities granted for their further consideration will be made wise use of, so that the set of conditions finally adopted may be in every way suitable for their purpose.

We agree, in principle, to the greater part of the draft before us. It is a real attempt to clearly define the responsibilities of the contractor, the purchaser and the purchaser's engineer, to hold the balance evenly between the conflicting claims of buyer and seller, to provide equitable terms of payment, a fair period of free maintenance, and an acceptable ratio between total value of contract and security to be provided by contractor. The rights of the contractor are also safeguarded in respect of penalty for late delivery, and he is permitted an unrestricted right of appeal to an independent arbitrator in case of dispute. We do not, however, approve of the form in which these principles have been embodied. The clauses in many instances appear unnecessarily verbose, the real meaning being hidden in the multitude of words. It should be possible, by a little rearrangement and the free application of the pruning knife, to maintain the spirit of the present proposals while greatly simplifying the phrasing of the various clauses.

As one of the speakers at the Institution pointed out, the draft bears evidence of being rather an adaptation of a set of conditions drawn up to meet other requirements than an attempt to draft clauses specially to meet the needs of electrical contracts.

It is along this line that we think the proposed conditions may be improved. To render them popular they must be clear, and should be terse, and it is surely possible to combine these qualifications in such a manner that they may meet with the approval of counsel, and so be intelligible, not merely to the business, but also to the legal, mind.

The Committee are doubtless wise in endeavouring to eliminate from the model set of conditions any stipulations as to labour conditions. These in most cases operate in a manner never intended by their promoters. Instead of aiding the general distribution of orders over the country, such stipulations, if insisted upon, either concentrate work in a few localities where local conditions permit of the regulations being carried out without unduly enhancing the cost of production, or they result in foreign competitors being placed at an unfair advantage. We hope that every effort will be made to restrict the addition of special labour stipulations in public contracts in cases where these conditions are otherwise adopted.

The present draft marks in many respects a distinct advance, and if it receives from all interested in the prosperity of the industry the consideration it deserves, it will, when amended in form and adopted by the Institution, appeal to a wide circle as claiming attention. If the moral influence thus exerted is sufficient to induce those responsible for the preparation of engineering specifications to sink, at any rate in regard to general conditions, their own individuality in their desire for the general well-being, this effort may do more than we at present think possible to place British commercial prosperity in the position we all wish it to occupy. It is just as essential from the commercial side of a business to minimise risks where this can be done without interfering with the rights of the purchaser, as it is from the manufacturing standpoint to reduce costs to the lowest possible point consistent with good quality and workmanship. The general adoption of fair and equitable general conditions would do much to lower the cost of carrying out work, inasmuch as it would considerably lessen the risks for which provision must be made in fixing prices.

A Nice Point of Patent Law.

THE case of the Reason Manufacturing Company, Limited *v.* Moy, of which we published a full report last week, raised a simple but very interesting point in connection with the validity of a patent. The plaintiff company claimed damages for the infringement of a patent for boxes for covering electric fuses in such a manner that the danger of two fuses being touched at the same time was completely avoided. The patentee had adopted (in 1894) the ingenious plan of placing his two fuse boxes back to back so that each of them automatically prevented the one being opened when the other was open. Mr. J. G. Lorrain, who was called as a witness for the plaintiffs, said that down to 1894, he knew of no devices which protected persons who were unskilled and careless. The invention claimed was a fuse box arranged in such a way as to prevent any danger of a short circuit. The defendants, whose infringing apparatus was similar to the plaintiffs, maintained that the invention in question was not the proper subject matter for letters patent. All that the patentee seemed to have done was this; he selected the sort of fuse boxes which would do, and placed them back to back so close together that one could not be opened when the other was open. Mr. Justice Byrne found for the plaintiffs. In the course of his judgment he said, "fairly used, this invention does to my mind obviate what it is desirable to obviate. It is useful, novel and it contains some invention." This case is certainly very near the line which patent lawyers draw between contrivances which may or may not form the subject matter of valid letters patent. "Invention," said Lord Justice Rigby upon one occasion, "consists in many cases of putting together items of common knowledge which no one else has ever thought of combining." In the

case under notice, the inventor took a fuse box which was known, and a simple device for preventing two adjacent cavities being open at the same time, the result being a fuse box which constituted a marked improvement on those which had been previously known. Simplicity is no answer to the statement that a contrivance shows inventive genius. In the case of Vickers *v.* Siddell, 7 R.P.C. 304, the invention consisted of an apparatus composed of a wheel and endless chain for turning heavy forgings, the wheel being internally toothed, and having a ratchet working in it, by means of which the wheel was caused to rotate, and the forging which rested in the endless chain could thus be turned from time to time to the extent desired. It was admitted that the elements were old. Forgings had long rested in an endless chain, and the idea of turning such forgings by rotating the wheel over which the chain passed was not new, and ratchet working in teeth was a well-known device for causing a wheel to rotate. But the result of the patentees' combination was a new apparatus of an extremely simple character, which possessed the advantage of being easily moved from place to place, and applied wherever wanted. The Court of Appeal and the House of Lords held that this new and useful combination of old materials was good subject matter for a patent.

Air-spaced Cables.

THE paper on this subject, read by Mr. G. E. Fletcher before the Manchester Section of the Institution of Electrical Engineers, is interesting; it indicates the remarkable progress which the use of paper cables is making. The paper also is a good example of practical work done in matters of detail. In one or two points Mr. Fletcher is not precise, thus, while stating that the "minimum radial depth of the lead sheathing should be 100 mils. for a five-pair," he does not state to what size conductors this refers; a "five"-pair seems a somewhat unusual combination and hardly susceptible of a good make up. In specifying the electrostatic capacity of the wires, the important omission is made of not stating whether the values given are for "wire to wire" or "wire to earth" capacity; these values differ very materially, and it is most necessary that it should be indicated which is meant. It is observed that the mica plates for the lightning arresters are stated to be as much as 16 mils. in thickness; this is greater than the thickness (10 mils.) allowed by the Postal Telegraph Department, and materially reduces the protecting power. Mr. Fletcher condemns the system of having the cables drawn into pipes (a system exclusively adopted by the Post Office), and advocates the use of troughing in which the cables are laid. The Post Office, however, presumably, does not find the trouble of the lead gaining over the wires (in one case stated by Mr. Fletcher the lead sheath is said to have gained *18 feet* over the conductor); it would appear as if Mr. Fletcher's method of drawing-in were decidedly defective, or the pipes used were not properly smoothed inside. We notice that Mr. Fletcher has experienced the difficulty of effectually sealing the leads when changing from open to cable work; considerable difficulty in this respect, we believe, has always been found, and it is not by any means an easy matter to get over it satisfactorily.

Horsfall Destructors.—A few days ago the foundation stone of a new refuse destructor for Taunton was laid by the Mayor (Mr. A E. Perkins). It was stated that after exhaustive inquiries the Corporation had unanimously decided to adopt the Horsfall system, as recommended by Lord Kelvin, and had commenced the erection of a four-cell plant, capable of converting 40 tons a day into innocuous clinker.

PARLIAMENTARY.

Cavehill and Whitewell Tramways Bill.

Sir Samuel Hoare presided on 23rd and 24th ult. over a Select Committee of the House of Commons, which inquired into the above Bill.

Mr. Moon, K.C., in opening the case for the company, said that the object of the Bill was not the construction of tramways, but the electrification of existing tramways of a total length of 3¼ miles running between the terminus of the Belfast Street Tramways Company at Chichester Park and Glengounly Gardens out into the country. The tramways were authorised in 1881, and were opened during the following year. Originally they were entirely in the county of Antrim, but now that Belfast had extended its borders a portion of the tramways was within the city. In the first instance the company were authorised to use mechanical power, and at the outset they ran the tramways by steam, but in 1892 the retrograde step was taken of working them by horse-power. Now they wished to work them by electricity, and the only real opposition came from the Belfast Corporation, who maintained that if the line were electrified, they ought to have a purchase clause inserted in the Bill. Of course, as the Committee were aware, the Tramways Act of 1870 did not apply to Ireland, and there was no similar provision which was contained in that Act applicable to Ireland compelling a tramway company to sell their undertaking at practically the price of old iron to the local authority. The Belfast Corporation had seized this opportunity to ask the Committee to impose a purchase clause, which, if granted, would have the effect of altering the general law as applied to Ireland. If they were proposing an alteration in the general law in the case of a tramway which was seeking power to construct a line for the first time, there might be something in the argument of the Corporation. But here they sought to have a clause inserted in the Bill which would enable them to purchase an undertaking which had existed for many years, and for which they would pay merely the value of old iron. The company had a right of ownership in perpetuity, and it was now sought by the Belfast Corporation to take away that right by the insertion of a purchase clause. The fact that the tramways were not purchaseable by the local authority really constituted the company's most valuable asset. The company had not to come to Parliament for powers to electrify the line, as that was provided for in the original Act. All they asked for was power to erect poles for the overhead electrical equipment. The electrification of any tramway was a most expensive matter, and although he admitted it might be reasonable to give the Corporation the right of purchase if the lines in question were to be continued to be worked by horse traction, now that the company were going to spend a large sum of money for the purpose of bringing their undertaking to an efficient state, it did not seem to be the occasion for altering the conditions under which the original powers were granted. A further argument against granting a purchase clause lay in the fact that a portion of the tramways was outside the boundaries of the Corporation, and they had no powers to purchase lines not within their own borough; and therefore it might happen that the company would be left with half of the system in their hands. If Parliament were to allow the occasion of a tramway company applying for powers to electrify their system to be seized by the local authority for the purpose of getting a right of purchase, the result would be that companies placed in the same position as his clients, would continue the old system of horse traction.

Mr. Fitzgerald, K.C., who represented the Belfast Corporation, said he should not attempt to deny that the proposed electrification was not desired by the public—his sole point would be that the Corporation were entitled to the purchase clause they were seeking.

Mr. A. Nance, a director of the company, gave evidence in favour of the Bill. He said that practically everybody in the district wished to have the tramways worked by electricity. To get over the opposition of a few people they would lay the tramways in the middle of the roads instead of at the sides. In the days when they obtained power to run the tramways with mechanical power, the only form of electrical power for tramways was the storage battery They now proposed to use the overhead system. They were not in a position to find the necessary capital themselves, but they had made a contract with the British Electric Traction Company, who had agreed to construct and fully equip the tramways for electrical working. The fact that the tramways were not purchaseable by the local authority was a very valuable point with the company in raising capital.

In cross-examination, Witness said it was true that the Tramways Company had practically sold itself to the British Electric Traction Company. He considered that the electrification of the tramways would be a great benefit to the district. The existing capital of the company was £15,000, and under the arrangement with the Traction Company that was to be turned into 6 per cent. preference shares, and an additional £45,000 of capital was to be found by the Traction Company, who were also to appoint two directors on the board.

Other local evidence having been given in favour of the scheme, Mr. J. S. Sellon, engineer to the British Electric Traction Company, said he was acting as engineer for the scheme, and from his knowledge of the district he was satisfied that there were no physical difficulties in the way of applying electricity to the tramways.

Sir Daniel Dixon, the Lord Mayor of Belfast, gave evidence against the Bill, and said that the Corporation were unanimous on the point that, if it was allowed to pass, a purchase clause should be inserted.

Mr. Harrison, K.C., for the Belfast Corporation, said that,

although no formal resolution had been passed on the subject, he was authorised to say that the Corporation were quite willing to give the shareholders in the Tramways Company exactly what the British Electric Traction Company were paying for the undertaking. The Belfast Street Tramways would become the property of the Corporation in 1907, and it was most desirable that there should be only one authority for all the tramways in the district. There would be the further advantage that only one power station would be necessary for both systems. It could not be suggested that there was any pressing necessity for the application of electrical traction to the Cavehill and Whitewell lines, and the Corporation were ready and willing to bring in a Bill next year to purchase the undertaking and work it by electricity.

Mr. H. Lloyd, K.C., replied for the promoters, and said that if the Committee adopted the suggestion of the Corporation they would be acting very unreasonably. He hoped, therefore, the Committee would pass the Bill and refuse any purchase clause.

In the result the Committee found the preamble of the Bill proved.

Mr. Harrison, K.C., said that the Belfast Corporation would take no part in the proceedings relative to the clauses, but would reserve their rights for consideration in the House of Lords.

Scarborough Tramways.

This Bill incorporates the Scarborough Tramways Company, and empowers the company to make and maintain tramways and to execute certain street works in the borough. It came before Mr. J. W. Lowther, Chairman of Committees in the House of Commons on 24th ult. as an unopposed measure. Mr. A. Campbell-Swinton, engineer, and the solicitor of the Bill, proved the preamble formally.

Sir Chandos Leigh (the Speaker's counsel), said there were two or three points to which he must draw the chairman's attention. The Corporation wanted to subscribe to the company's scheme, but the Local Government Board objected to this unless the clause was drafted in a particular form. Such a clause had been agreed upon between the parties and Mr. Boyce, representing the Local Government Board. The clause imposed certain restrictions on the Corporation before they would be allowed to subscribe.

The Chairman asked if there had been any other such case this session.

Sir Chandos Leigh replied that there had been very few cases of the kind since that of the Hull and Barnsley some years ago. The power to subscribe was sought by the Corporation on the strength of the Light Railway Act, 1896.

Mr. Lowther, after examining the clauses, allowed the Bill to pass through the Committee stage, and it will in due course be reported for third reading.

Birkenhead Corporation Bill.

The Omnibus Bill of the Birkenhead Corporation came before a Select Committee of the House of Commons, presided over by Mr. Bell, on 24th ult.; and the preamble having been found proved, the Bill was ordered to be reported to the House for third reading. Clause 13 asks for power to supply electrical energy in bulk in neighbouring district, and a further clause gives the Corporation power to supply electric fittings to consumers.

Salford Corporation.

On 23rd ult. the Salford Corporation Bill came before a Committee of the House of Commons, presided over by Mr. Bell. The measure was previously before a Committee of the House of Commons presided over by Col. Bowles, so far as the tramway clauses were concerned, in order that these might be considered along with the Manchester Corporation Tramways Bill. The tramways clauses were altered by an agreement, and the Bill was reported to the House, but recommitted in order that the police and sanitary clauses might be dealt with.

The Committee found the preamble of the Bill proved.

Preston Tramways.

A Select Committee of the House of Commons, presided over by Mr. Bell, on 23rd ult. considered the Preston Corporation Bill, which, amongst other things, sought to empower the Corporation to construct additional tramways in and adjacent to the borough.

Mr. Gerald Fitzgerald appeared for the promoters, and explained that it was intended to reconstruct the existing tramways, and extend the systems by constructing a new tramway in an adjacent township to the borough of Preston. The present tramways were worked by a lease of the Corporation by horse power, and it was proposed to substitute electric traction. The lease expires on January 1st, 1904, and the lessee also worked the other tramways in Fulwood. The tramways were at present worked on the 3ft. 6 in. gauge, but in 1900 the Corporation promoted a Bill, which became law, and amongst other things, altered the gauge of 3 ft. 6 in. tramways to a 4 ft. gauge. Since then the 4 ft. 8½ in. gauge had become the dominant system. Blackburn, which was 9 miles away, laid to the south-east of Preston, and the means of communication was along the high road. It was thought advisable and desirable to join Blackburn and Preston by the 4 ft. 8½ in. gauge system. There were light railways in progress in the neighbourhood, and the Light Railway Commissioners had always laid stress on a standard gauge. The motive system to be adopted was the overhead electric trolley system. The lines proposed would be 8 miles 2 furlongs within the borough, double lines, and 4 miles 7 furlongs single line, a total of 13 miles 1 furlong within the borough, and the estimated cost of the construction of these lines was £156,764. Outside the borough, in the Urban District of Fulwood, and with the consent of the Urban District Council of Fulwood, it was proposed to add 2 furlongs of double line, and 1 mile 2 furlongs of single line at an estimated cost of £14,190. The Fulwood lease expired at the same time as the Preston lease. For cars and depôts it was estimated that £23,320 would be needed, and for generating station and transforming apparatus, £25,802, which, with other outlay, would make a total estimated expenditure of £290,954.

After hearing the evidence of Mr. Cookson, the borough engineer, the Committee declared the preamble of this part of the Bill proved.

Electric Lighting Provisional Orders (No. 4).

On 24th ult. Electric Lighting Provisional Orders (No. 4) came before the Examiner of the House of Commons for proof of compliance with Standing Orders. The Bill confirms the following provisional orders granted by the Board of Trade under the Electric Lighting Acts, 1882 and 1888:—

Aberdare.—Provisional order granted to the Urban District of Aberdare, in the County of Glamorgan. The undertakers are authorised to charge 10s. for any amount up to 20 units, and for each unit over 20, 6d.

Amble.—Order granted to the Northern Counties Electricity Supply Company, Limited, in respect of the Urban District of Amble, in the County of Northumberland. The area scheduled is the Urban District of Amble, as constituted at the commencement of the order. The undertakers may charge 13s. 4d. for any amount of electricity supplied up to 20 units, and for each unit over 20 units 8d.

Dover.—Order granted to the Mayor and Corporation of Dover. Clause 4 provides that the Board of Trade shall fix a date for the commencement of the order when they are satisfied that the undertakers have completed the purchase of the undertaking of the Dover Electricity Supply Company, Limited. The authorised charges are 11s. 8d. for any amount up to 20 units, and 7d. per unit afterwards.

Frinton-on-Sea.—Order granted to the Frinton-on-Sea and District Electric Light and Power Company, Limited, in respect of the Urban District of Frinton in the County of Essex. The registered office of the company is 6, Old Jewry, in the City of London. With regard to purchase by the local authority, in lieu of the periods of 42 years and 10 years mentioned in Section 2 of the Electric Lighting Act, 1888, there shall be substituted the periods of 30 years and and five years respectively. The undertakers will only not be authorised to break up streets for the purpose of laying down new distributing mains during the months of July, August and September in any year. They will be entitled to charge 11s. 8d. for any amount up to 20 units, and 7d. per unit afterwards.

Gillingham.—Provisional order granted to the Urban District Council of Gillingham, in the County of Kent. A special provision is made protecting the rights, powers and privileges of the Conservators of the River Medway. The order will not come into force until the Board of Trade is satisfied that the undertakers have completed the purchase of the Gillingham part of the Chatham, Rochester and District Electric Lighting Company's undertaking. The following charges are scheduled:—(*a*) Of any amount up to 20 units 10s., and for each unit over 20 units 6d.; or (*b*) At the option of the consumer (1) for any amount not exceeding the equivalent of 91 hours of supply at the maximum power which has been demanded by him at the rate of 7d per unit, and (2) for any further quantity exceeding the equivalent of 91 hours of supply at such maximum power at the rate of 3d. per unit.

Hindhead and District.—Order granted to John Grover, of East Lynn, Finsbury Park, in the County of Middlesex, in respect of the parish of Shottermill, and a portion of the parish of Frensham in the County of Surrey, and a portion of the parish of Headley in the County of Southampton. The powers given by the Order are not to be exercised unless the undertaking is transferred to a registered company. The authorised charges are 13s. 4d. up to 20 units, and 8d. per unit afterwards.

Leadgate.—Provisional Order granted to the Northern Counties Electricity Supply Company, Limited, in respect of the Urban District of Leadgate in the County of Durham. The authorised charges are 11s. 8d. up to 20 units, and 7d. per unit afterwards.

Leatherhead and District.—Order granted to the Leatherhead and District Electricity Company, Limited, in respect to the parish of Ashtead, in the rural district of Epsom, and the parish of Mickleham, in the rural district of Dorking, in the County of Surrey. The registered office of the company is 3, Arundel Street, London, W.C. Undertakers will be authorised to charge 13s. 4d. for any amount up to 20 units, and beyond that they may charge for any amount not exceeding the equivalent of 91 hours of supply at the maximum power demanded at the rate of 8d. per unit, or for any amount exceeding the equivalent of 91 hours of supply at that maximum power at the rate of 4d. per unit.

Paignton.—Order granted to Jules de Meray, Edward Whittred, Iltyd Peterson and William Thomas Pressland, carrying on business under the name of the Provincial Electric Supply and Traction Company in respect of the Urban District of Paignton, in the County of Devon. The powers given by the Order are not to be exercised unless the undertaking is either purchased by the local authority, or if not so purchased, transferred to a registered company. The local authority may exercise the option of purchase within six months by paying the promoters £200.

Stanley.—Order granted to the Northern Counties Electricity Supply Company, Limited, in respect of the Urban District of Stanley, in the County of Durham. The local authority may at any time after the expiration of 10 years, give two years' notice to the undertakers to sell at a price equal to the value of the undertaking as a going concern. Failing agreement, the price is to be determined by arbitration. The undertakers are entitled to charge (*a*) for private purposes any amount up to 20 units 11s. 8d., and for each unit over 20 units 7d.; (*b*) for public purposes for any amount up to 20 units 6s. 8d., and for each unit over 20 units 4d., without prejudice to the provisions of Sec. 34 of the schedule to the Electric Lighting (Clauses) Act, 1899, as to energy supplied to public lamps.

Cleethorpes Tramways and Lighting Bill.

Sir R. Gunter's Select Committee of the House of Commons on 22nd and 23rd ult., considered the Cleethorpes Improvement Bill, which sought to confer power on the Urban District Council to construct and work tramways, and make further provision with regard to the supply of electricity. Mr. Ram, K.C., Mr. Vesey Knox, and Mr. A. M. White, were counsel for the Bill, and there were no petitioners against it, although the Home Office and the Local Government Board were represented.

Mr. Ram stated that the tramway proposed commenced at the end of the existing tramway (which terminated at the end of the existing sea wall), and the proposed tramway was to be carried along the sea wall.

Mr. W. T. Douglas, civil and electrical engineer, stated that the sea wall to be constructed would cost £22,300, and the tramway extension, £5,000.

The opposition of the Local Government Board was directed to portions of the Bill having no connection with the tramway or electrical proposals. With regard to the electricity supply, power is given to purchase a generating station and plant for the Great Grimsby Street Tramways Company.

The preamble was declared proved so far as the tramway and electricity portions were concerned.

The North-East London Railway.

Sir Douglas Fox, engineer to the North-East London line to Southgate, explained the construction of the proposed railway, and said it was the first intention of the company to have a fireproof footpath 3 ft. wide between the rails. After having heard the evidence of Col. Yorke, further consideration had been given to the matter, and they proposed to have a second emergency footway for passengers if it met with the approval of the Board of Trade. If, as they intended, they had a 13 ft. 6 in. tunnel, there would be no difficulty in having such footways along the whole of the railway. The conductor would be carried at the side of the train under the emergency platform, so there could be no possibility of shock to any of the passengers. In view of the evidence of Col. Yorke, the sleepers on which the lines would be laid would not be creosoted. Witness having described the route of the proposed line and the various stations, the Committee adjourned till Monday.

Bradford Tramways.

A Select Committee of the House of Lords, presided over by Lord Pirbright, on 24th and 25th ult., had before them the Bradford Corporation Bill which authorises the Corporation to construct additional tramways, waterworks, street improvements, &c. The proposals in the Bill were to construct 13 sections of tramways of varying lengths, one line of which is nearly 3 miles long, and five lines over a mile in length. One tramway goes outside the borough in the Urban District of Schelf, and by the other parts of the Bill the Corporation are authorised to purchase the undertaking of the Schelf Corporation. The estimates for tramways were £84,248, and £3,000 was also allocated for electrical purposes in connection with the tramways.

The whole of the opposition to the Bill was confined to the waterworks part, and the Committee found the preamble proved.

Abertillery Electric Lighting.

The Omnibus Bill of the Abertillery Urban District Council came before a Committee of the House of Lords, presided over by Lord Pirbright, on 25th ult. Amongst other things sought in the Bill was power to make further provision for the supply of electricity. Last session the Urban District Council was empowered to supply electricity. The estimate of the amount required for the purpose was £50,500.

The whole the opposition was directed to the parts of the Bill not connected with electricity, and the Committee found the preamble of the Bill proved.

London County Council (Subways and Tramways) Bill.

On 23rd ult. a Select Committee of the House of Commons, presided over by Mr. Hobhouse, began the consideration of the above Bill. Mr. E. Pollock, K.C., Mr. J. M. Freeman, K.C., and Mr. B. Wilkinson appeared for the promoters; Mr. Reader Harris, K.C., represented the Metropolitan District Railway; Mr. Bellews the Holborn Borough Council; Mr. Balfour Browne, K.C., and Mr. E. H. Lloyd, the Great Northern and Strand Railway Company; and Mr. Blennerhassett, K.C., and Mr. R. Berkeley, the Westminster City Council.

In opening the case, Mr. Erskine Pollock explained the objects of the Bill on Wednesday, and stated that the proposal of the County Council was to construct a tramway worked by electricity and to be placed in a shallow subway. The line was to commence at Theobald's Road, where it would form a junction with the existing tramway leased from the County Council. It would proceed along the level until Southampton Row was reached. Then it would go below the level of the street in a subway varying in depth from 3 ft. to a little more, and pass along the site of the proposed new thoroughfare from Southampton Row to the Strand. There the line would turn towards the Embankment, which it would reach near Waterloo Bridge, where it would emerge into the open. The County Council were at present owners of 74 miles of tramways out of the 115 miles in the whole of the country. They had given notice to acquire 16 miles more, and they intended, when the proper time arrived, to acquire the remaining 25 miles. Parliament had sanctioned a Bill enabling the County Council to apply electricity to the working of the tramways, and at no distant date it might be anticipated that they would be able to work the whole of the system in London by electricity. The idea of the scheme was borrowed from Boston, where they had a shallow tramway five miles long. The cost of the tramway would be about £250,000, and the length of the tramway about ¾ mile. With regard to the petitioners, the local authorities were asking for protection so far as their streets were concerned, and the railway companies complained of competition. He denied that the subway would increase the cost of the tube of the Great Northern & Strand Railway Company.

Mr. FitzMaurice, chief engineer to the L.C.C., explained the works which it was proposed to undertake, and said that the subway would take all sewers, pipes and cables.

In cross-examination, Witness admitted that the tramway, at one place on the Embankment, would be only about 3 ft. above the Metropolitan Railway, and as it would be an electrically worked line, it was, of course, across a railway proposing to use electricity, and he did not see any chance of interference with the Metropolitan Railway's works.

Mr. A. Baker, tramways manager of the L.C.C., stated the result of his visit to America to investigate the working of shallow tramways there. They thoroughly investigated the working at Boston, and he thought it was an exceedingly good system. The success of the Boston tramway had been very great.

Mr. J. A. Baker, vice-chairman of the Highways Committee of the L.C.C. was called, and endorsed all the evidence of the previous witness.

Mr. J. H. Rider, electrical engineer to the Council, stated that the proposed tramway would be on the conduit system. Cars would be single-decked, and the motors would be cased in steel and fireproof. The tunnel would be lighted throughout with incandescent lamps.

In cross-examination, Witness said that they would use electrical power in the proposed subway of similar voltage to that it was proposed to use in the Metropolitan District Railway when it was electrified.

On resuming, on 24th ult, Mr. Reader Harris, K.C., opened the case on behalf of the District Railway Company. He said he hoped the Committee would not pass the preamble of the Bill. If they saw fit to do so, however, he hoped they would put in a clause stopping the tramway before it debouched on to the Victoria Embankment. The idea of the Bill, he thought, was an alarming one. It was proposed to make in the middle of the Embankment roadway a tramway, and to have a station where the trams would arrive, shunt, and depart. It would be laid over where the District Railway ran under the Embankment, and the additional weight upon the girders of the railway would involve great danger.

Sir J. Wolfe Barry, consulting engineer to the Metropolitan District Railway, said the company paid £200,000 to the Metropolitan Board of Works for the wayleave under the Embankment. The railway had been constructed at a cost of £900,000 per mile. The placing of the additional weight of the running of the tramcars from 8 to 10 tons each upon the girders of the railway he looked upon with great alarm, and he should not be satisfied with the safety of the railway under the present construction of girders. In his opinion, quite apart from any matter connected with the District Railway, the making of a terminus on the Embankment at the end of Savoy Street, would be an intolerable nuisance from the point of view of the public.

Cross-examined, Witness contended that if the Bill were passed the girders of the railway would be strained an additional 2 tons per sq. in. by the running of the trams. The only way the railway could guard against danger arising from increased weight passing over the roadway would be by reconstruction, which would be a costly matter.

Mr. Pollock intimated that in order to meet any difficulties of the railway company, the County Council were willing to go to the expense of reconstructing a portion of the railway if necessary.

Mr. Harris said that would not satisfy the railway company.

Mr. Blennerhassett, of the Great Northern and Strand Railway, asked for a clause to be inserted in the Bill preserving the rights of the company under the Act of 1899 in respect of their railway under the new street of the Council.

Mr. Bellews also asked the Committee for the insertion of protective clauses in the Bill under the Brompton and Piccadilly Circus Railway Act, 1897.

The Committee having deliberated in private, the Chairman announced the preamble of the Bill proved. He said the Committee thought the District Railway Company, if they desired it, should have a protective clause regarding the superstructure of the railway where the tramway would cross it. The Committee were

willing to put in a saving clause on behalf of the Great Northern and Strand Railway, but in regard to the Holborn Town Council they were not prepared to give the clauses.

The Committee adjourned.

On 25th ult. the Committee considered a number of clauses submitted by the City of Westminster to give the city certain rights over alterations of drains and sewers, &c., during construction of works.

The clauses were rejected, and other clauses having been adjusted, the Bill was ordered to be reported to the House.

Tyneside Tramways.

A Select Committee of the House of Lords, presided over by Lord Stanmore, on 25th and 28th ult., considered the Bill promoted by the Tyneside Tramways and Tramroads Company for an extension of their existing system.

Mr. Balfour Browne, K.C., who appeared for the promoters, said the company was incorporated last year, and promoted a Bill for a considerable important tramways and tramroads.

In reply to the Chairman, Counsel said the distinction between a tramway and a tramroad was that the first was constructed on the public roads, and the latter on private property. The tramways sanctioned last session commenced where Wallsend joined Walker, and proceeded through the Tyneside district to North Shields. There was also a tramroad from Wallsend to Gosforth. This session the proposals were in three separate parts. The first was a tramway from Blyth to Bedlington, through Cowpen, and this was not opposed. Secondly, they proposed to extend the Gosforth tramroad so that the populous district of Coxlodge could be served; and thirdly, it was proposed to construct a tramway from Gosforth to North Gosforth. The opposition of the North-Eastern Railway Company had been withdrawn, and the only opposition was that of the Newcastle Corporation, who objected to the Gosforth tramroad crossing their tramway. His answer to that was that there would be no difficulty in having safeguards in the way of signalling to prevent accidents.

Evidence was called in favour of the Bill, including Mr. Stephen Sellon, who stated that he knew cases where one tramway system crossed another, and in such cases the Board of Trade always made regulations for the stoppage of cars before passing over the crossing.

Local evidence as to the boon the tramway would be to the districts concerned was also given.

Mr. W. Cail, a member of the Tramways Committee of the Newcastle Corporation, stated that in his opinion the crossing would be exceedingly dangerous.

The Committee passed the preamble of the Bill without calling upon the promoters to reply.

London United Tramways Bill.

The Standing Orders Committee of the House of Lords have reported that Standing Orders ought to be dispensed with in respect of the London United Tramways Bill provided that the powers to construct Tramways Nos. 1, 2, 3, and 8 be struck out of the Bill. These lines are in the area of the London County Council, who refused consent.

Dartford Improvement Bill.

Sir R. Gunter's Select Committee of the House of Commons last week passed the preamble of the Dartford Improvement Bill, which, amongst other things, authorises the Urban District Council to make further provision with regard to the electric light undertaking, and to supply electric meters and fittings.

Northumberland Tramways.

Lord Stanmore's Select Committee of the House of Lords on 25th ult. considered the Northumberland Electric Tramways Bill.

Mr. Balfour Browne, K.C., represented the promoters, who are the Northern Counties Electricity Supply Company. The object of the Bill, he said, was to authorise the construction of tramways from Morpeth to Bedlington, from Bebside to Blyth, and from Ashington to Newbriggin. The company, which was established in 1901, had a provisional order for Blyth, and was erecting a generating station from which to supply electricity in that town. They had also provisional orders for the supply of electricity in Morpeth, Ashington and Newbiggin.

As the objectors to the Bill, the North-Eastern Railway Company, made no appearance, only formal evidence was called to prove the preamble, and the Bill was ordered to be reported to the House.

Islington and Euston Railway.

The Standing Orders Committee of the House of Lords have decided that the Standing Orders not complied with in respect of the petition for additional provisions in the case of the Islington and Euston Railway Bill ought to be dispensed with, and leave given to the Committee on the Bill to insert the additional provision. The provision proposes certain financial arrangements to allow of combination with the City and South London Railway Company.

North-East London and City, and North-East Suburban Lines.

On 24th ult. Mr. Balfour Browne, K.C., in opening the case for the above companies, said that last year they were in opposition. At that time the North-East London Company had a line to Walthamstow in competition with that of the City and North-East Suburban Company. The Joint Committee of last year expressed the opinion than an extension further north than the North-East London line proposed to go would be very desirable, in view more especially of the area of land taken by the London County Council for erecting workmen's dwellings, and that, therefore, the Walthamstow branch was not needed if the line of the City and North-East Suburban Company were sanctioned. In order to comply with that request of the Joint Committee, the Walthamstow branch was now withdrawn. The Joint Committee also gave it as their opinion that the City and North-East Suburban route from the centre of the City along Bishopsgate Street was undesirable, and suggested that a better route would be eastwards from the City along Leadenhall Street, and then going in a north-easterly direction to Victoria Park. They had complied with that suggestion also, and the new North-East Suburban line running to Chingford took the very route indicated by the Committee. The line had also been extended to Southgate past the workmen's dwellings which the County Council were erecting at Tottenham, because there was a district there which needed a great deal of development. The total length of the City and Suburban line was 15½ miles, only four of which would be tube railway, while the North-East London line was 13¼ miles long, 9½ of which would be underground. The central line from Hammersmith to Charing Cross was the pivot on which the whole scheme depended for a through route from the extreme West to the East of London.

The Committee then adjourned till Friday.

On Friday, 25th ult., at the opening of the Committee, Mr. C. Rawlings, chairman of the Parliamentary Committee of the Hammersmith Borough Council, was examined as to the attitude of the Council in respect of the scheme. He said that the Council, in giving their support to the amalgamated scheme, were influenced by the concessions in the way of road widenings, which the London United had agreed to make, and also by the fact that by the amalgamation, the needs of the neighbourhood would be best served.

Sir Edward Clarke then addressed the Committee on the general case for the combined scheme. In the first place, he said he wished to repudiate the suggestion that there had been any sort of bribe offered to the Hammersmith Borough Council to secure their support to one of the two competing lines, and that they had been ready to accept the highest terms. The present inquiry would be a very costly and elaborate one, and everybody must hope that it would result in a scheme being sanctioned which would be a practical one, and which would satisfy the requirements laid down by Parliamentary Committees in the past. It was of the utmost importance that any scheme which proposed to carry passengers from Hammersmith to the City, and thence to the east of London, should be a through line, and not a circle. A circle in the centre of the metropolis would be a most mischievous thing to establish as it would set up a monopoly, and access could only be gained to the circle lines by means of confluent junctions. Confluent junctions were very difficult to arrange, and when made were sources of some danger and of inevitable delay. The problem to be solved in this case was—that having got the people from the large districts outside London to Hammersmith and Shepherd's Bush by tramway—how were they to get them into the City and through to the East-end? As the London United already had control by means of its tramways of the passenger traffic to Hammersmith and Shepherd's Bush, he submitted that they were more interested than anybody else in developing and continuing it straight through to the City. He did not think he need say much about the financial aspect of the question, as he had no doubt that the Committee would have been quite satisfied from the evidence of Mr. Clinton Dawkins that the promoters would be able to find the necessary capital. The scheme was one of the most complete for the construction of tube railways that had come before Parliament. It was promoted by gentlemen who were best qualified to carry it out; its solvency was assured, as was its actual construction. It would tap traffic from the North, East, South, and West, and carry passengers right through London, and would give such facilities in the way of through fares as had never before been possible by any company. There would be one board of directors, gathered from the various lines, which would secure unity of administration, which was a most important thing from the public point of view. He submitted that the scheme should be sanctioned by their Lordships as one that would best tend to relieve the pressure and overcrowding that now existed in the central parts of this metropolis.

The Chairman said he would like to know from Sir E. Clarke whether he intended to lay before the Committee a definite scheme of administration of the combined railways as presented before the Committee.

Sir E. Clarke replied that he was given to understand that an agreement as to combined management was being prepared, and would be laid before their Lordships.

Mr. Littler, K.C., expressed the opinion that counsel should have an opportunity of seeing the scheme as early as possible. In his opinion it would be impossible to carry out the amalgamated scheme this session from the point of view of procedure.

Sir E. Clarke replied that he did not see any difficulty in the matter. If the Committee allowed the combined scheme to proceed, it would be perfectly easy to carry it out in accordance with Parliamentary rules.

Mr. S. Samuel, M.P., for Whitechapel, called on behalf of the City & North-East Suburban Railway Company, said he was firmly of opinion that the proposed line from the Mansion House to Waltham Abbey would be of great value to the working classes of the East-end.

Cross-examined, Witness said he was aware that the Great Eastern Railway Company had exerted themselves a good deal to cope with their increased suburban traffic, but despite that, the trains were seriously overcrowded at certain hours in the morning and evening.

The Chairman remarked that it was important to know whether or not the Great Eastern Railway was able to deal with the traffic that the proposed new railway hoped to cater for.

Mr. Freeman, K.C., for the Great Eastern Railway, said he should be able to satisfy the Committee that his company could meet the needs of the traffic, and that there was no justification for this additional line, and he should ask the Committee not to sanction it.

Mr. Spencer Charrington, M.P., Mr. D. J. Morgan, M.P., and Mr. Claude Hay, M.P., gave similar evidence to that of Mr. Samuel, Mr. Hay stating that his own personal experience had thoroughly convinced him that the Great Eastern Railway was quite incapable of dealing with the suburban traffic.

The Chairman observed that last year the Great Eastern themselves promoted a scheme and that rather conceded the point that they themselves were aware of the necessity that existed for increased accommodation.

Mr. Freeman said the company had already taken steps to relieve the congestion, and were contemplating further action.

Replying to Lord Knutsford, Mr. Freeman said it was true that the Great Eastern Company were not promoting their proposed lines this session for the reason that they had got something much better.

Metropolitan District Railway Bill.

A Select Committee of the House of Commons, presided over by Mr. H. Hobhouse, on 22nd, 23rd and 24th ult., considered the Metropolitan District Railway Bill, which seeks to enable that company to work their undertaking by electrical energy, to acquire lands, to constitute the railway under their Act of 1897 a separate undertaking, to raise further capital, and to confirm the award of the Board of Trade as to the system to be used in working by electrical power the undertakings of the company and the Metropolitan Railway Company.

Mr. Pember, K.C., stated the case for the promoters, and said that one of the objects was to lay down certain cables for the supply of electricity to the system to enable it to adopt electric traction in place of steam. It was proposed to erect a generating station at Lots Road, Chelsea, on land acquired from the Chelsea Borough Council, and the cables would run by way of Earl's Court Road, Radcliffe Gardens, and Edith Grove to the railway. Part 2 of the Bill would give power to acquire land for the purpose of erecting a generating station for the Chelsea Borough Council. Part 3 would give powers of working by electric power portions of the London and South-Western Railway between Turnham Green and Richmond, and between Putney Bridge and Wimbledon, the East London Railway, and the Hounslow and Metropolitan Railway. It meant that inasmuch as the Metropolitan District trains in the ordinary way of working would run on certain parts of the South-Western and the Hounslow and Metropolitan Railways, therefore it was necessary to lay down the requisite apparatus for electricity. The promoters had entered into an agreement with the South-Western and Hounslow and Metropolitan Railways. Part 5 provided that the guaranteed stock to be issued by the company under Sec. 26 of the Whitechapel and Bow Railway Act, 1900, shall be known as Metropolitan District (Bow Extension) second guaranteed stock, and shall rank for dividend after the Metropolitan District (Bow Extension) guaranteed stock issued under the Whitechapel and Bow Railway Act, 1898. These were matters of administration only. Part 5 proposed to constitute the deep level railway, authorised by the Metropolitan District Railway Act, 1897, or any part thereof into a separate undertaking. It was proposed that this line, which would run underneath the existing line, should serve as a relief line. In part 6, various matters were dealt with, including provision for running powers over a portion of the London, Tilbury and Southend Railway between Campbell Road and Barking, by agreement with that company. The only opposition to the Bill was with respect to the laying of cables and the extension of time for works.

Mr. R. W. Perks, M.P., the chairman of the Metropolitan District Railway, was called in favour of the Bill, and stated that the financial position of the company was much stronger than it had been in the past. Last July they had £1,000,000 subscribed, and now a capital of £5,000,000 had been subscribed to deal with this and other schemes.

Sir Alexander Binnie gave evidence in favour of the Bill, and deprecated the suggestion that the company should be required to submit their plans to the London County Council, because all railway companies were exempt from the London Building Act.

Mr. C. Munro, representing the Kensington Borough Council, opposed that portion of the Bill dealing with the cables, and objected to the ducts proposed by the company which would form two solid masses of concrete 6 ft. by 3 ft. under the roadways.

Evidence was called from the Kensington Borough Council, and suggestions were made that the ducts could be carried under side streets.

Mr. Freeman, K.C., for the London County Council, contended that the plans for the generating station should be submitted to the Council.

After further evidence had been called, the Chairman said the Committee were prepared to pass the preamble of the Bill, subject to certain conditions. While they had no desire to hinder an important public enterprise, they thought, considering the magnitude, novelty, and peculiar character of the proposal to convey this mass of cables under the public streets, that the work ought to be subject to the supervision of some competent public authority; and they considered that the most suitable authority in the matter would be the Board of Trade. They therefore proposed to insert a proviso in the Bill, the substance of which would be that as regarded the works authorised in Clause 5, detailed plans, including mode of construction and position in the streets should be subject to the approval, before actual construction, of the Board of Trade, and that future enlargements and alterations should also be subject to such approval. Also that in giving approval the Board of Trade should have regard not only to the safety of the public, but to the convenience of the road authority. They did not propose to give the London County Council any power to approve the plans for the generating station.

Tube Railway Committee.

On Wednesday, 23rd ult., the Committee re-assembled; Lord Windsor again presided.

Mr. J. Clifton Robinson, the general manager of the London United Electric Railways, was cross-examined by Mr. Littler, K.C., on behalf of the District Railway. Replying to questions, witness said it would not be possible to arrange throughfares in connection with the Metropolitan and District Railways unless those companies reduced their fares to that of the London United. He saw no difficulty in running an all-night service, because in the larger tunnels any necessary repairs would be able to be executed without stopping the trains.

Mr. Fraser, M.I.C.E., engineer to the London United Tramways in conjunction with Mr. Clifton Robinson, gave evidence on the engineering part of the scheme. He believed they would be able to work the entire scheme from one generating station, which was to be erected on the banks of the river at Hammersmith. They had scheduled land at Battersea Bridge in case it should be found necessary to have a second generating station. The combined scheme would offer great economies as regarded working, and as regarded advantages to the public in the way of through and cheap fares.

Cross-examined by Mr. Shiress Will, K.C., on behalf of the Albert Hall proprietors, the Witness said it was their desire to keep as far as possible from that place. They were, however, between the Scylla of the Albert Hall and the Charybdis of the Albert Memorial. Their centre line would be about 150 ft. away from the Albert Hall, at which point it would be about 75 ft. under the surface, and well in the London clay. It would not be possible to give the Albert Hall authorities what was known as the "Bank of England" clause. By that clause they would have to pay compensation for all damage or injury of every description that might from time to time arise either during the construction or in the working of the railway. If that was insisted upon, he was afraid it would be impossible to raise the necessary capital.

Mr. Shiress Will: It seems evident that as you are so reluctant to give my clients the advantage of this compensation clause, you must anticipate that the Albert Hall will be damaged?—No, I do not anticipate the slightest damage, but I think the clause quite unnecessary. As to whether protection should be given for a limited time, that is a matter for the Committee.

Continuing, Witness said he was aware that the Central London Railway Company had given a similar clause, and he should say that it made the raising of the capital more difficult than it would otherwise have been. He would also object to giving the clause to the governors of St. George's Hospital unless it was put upon them by the Committee. His reason for that statement was that the tube would be so far away from the Hospital that it could not possibly do any harm to the Hospital, but if they gave the clause to one building they would have to give it to others along the route. It was a most dangerous clause for a company to undertake, as it lasted for all time. He objected to it most strongly, even though it was inserted in the City & North-East Suburban Bill for the protection of the City & Waterloo Railway.

Evidence in support of the scheme from the point of view of its value in relieving the congestion of the East-end having been given by witnesses on behalf of the Shoreditch Borough Council, Mr. W. J. Bull, M.P., gave evidence strongly in support of the Bill as providing the best route to and from Hammersmith. He attached very great importance to the through connections that would be established with the tramway service of the London United at Hammersmith. He did not think it would be in the public interests that there should be amalgamation with the Central London Railway along the route. They had an example in the case of the South-Eastern and Chatham & Dover Companies as to the disastrous results that followed amalgamation. He was strongly of opinion that there should be healthy competition.

Cross-examined, Mr. Bull said it was quite true that the Hammersmith Borough Council had obtained great concessions from the London United Company, which included a considerable widening of the Hammersmith Broadway. It was not right to say that they had supported the present scheme because the London United were willing to pay them for it; but they supported it because it provided the best route. If the Central London had acted differently towards Hammersmith years ago, things might have been different now.

Other local evidence having been tendered in favour of the

scheme, the case for the London United Company closed, subject to Sir Edward Clarke addressing the Committee at a later stage if necessary.

On Monday, April 28th, before proceeding with the evidence, the CHAIRMAN stated that the Committee wished to have a more complete statement of the estimates of the proposal for the line from Hammersmith to Charing Cross and from the Mansion House to Waltham Abbey. They also wished to have a statement showing the estimates of the separate lines before the amalgamation of the Piccadilly and City, London United Electric Railways, North-East London, and the City and North-East Suburban Railways.

Mr. LITTLER, K.C., on behalf of the Brompton and Piccadilly Circus Company requested to be furnished with fresh copies of the Bill, so that it could be seen exactly what powers were abandoned and what retained under the amalgamation.

Mr. VESEY KNOX promised to give the statements.

After further consideration SIR DOUGLAS FOX continued his evidence, and was cross-examined by counsel representing the various interests. The original Walthamstow branch of the North-East London Company had now, he said, been abandoned, because the combination with the City and North-East Suburban Company had made it unnecessary. They were willing to lower the depth of their deviation to avoid St. Paul's Cathedral, so as to secure that there should be a depth of 20 ft. of clay; it was intended to go under the City and South London Railway at the Monument station. He saw no difficulty in arranging an exchange station with the Central London Railway at Liverpool Street, and he considered that the extension of the Central London Railway to Liverpool Street was the right course to adopt. He admitted with regard to the atmospheric condition of the Central London Railway that the recent arrangement of allowing trains to churn the impure air was not satisfactory, and his view was that the air of the tunnel must be changed by the introduction of a fresh current.

After evidence had been called with regard to the estimated value of the land and easements required for the North-East London line, the case for this line closed.

Mr. E. FOX was next examined with regard to the cost of the land and easements required for the City and North-East Suburban line, which he estimated at £803,071.

Mr. DEW, L.C.C., the secretary of the National Association for the Extension of Workmen's Trains, expressed the opinion that the City and North-Eastern Suburban line, which passed through the most crowded districts of London, would be a great boon to the community.

Mr. S. G. FRASER, joint engineer of the City and North-East Suburban Railway, explained the proposals which he said had been carried out in accordance with the views expressed by the Joint Committee which sat last session. The line would go from Leadenhall Street in a north-easterly direction to Victoria Park. It would reach Aldgate from Victoria Park by way of Cambridge Road and Whitechapel Road, and from Aldgate it would pass under the Metropolitan Railway by way of Mark Lane and the Monument, and hence to the Mansion House Station at such a level as to form a butt end junction with the deep level line of the District Railway Company. From the City to Victoria Park the railway would be a tube, but for the remaining portion, about 11½ miles, it would be open. The proposed stations were at Mansion House, Monument, Mark Lane, Aldgate, St. Mary's (Whitechapel), Bethnal Green, Haggerston, Victoria Park, Hackney, Temple Mills, Leyton, Lea Bridge Road, Hoe Street (Walthamstow), Forest Road, Higham Hill, Chingford Hall, Chingford Green, Gilwell Park, High Beech and Waltham Abbey. The total estimated cost of the works and land was £2,532,998. The cost of the electrical equipment, including the power station, was £900,000. Interest during construction was estimated at £206,000; compensation to District Railway, additional works and cost of finance, £361,000; a gross total of £4,000,000.

Replying to counsel for the Metropolitan District Railway Company, WITNESS said the originators of the scheme were Walthamstow people, but the chairman of the Metropolitan District Railway Company had offered financial support. At that time the line was so laid out that it would have been a good thing for the District Railway. They were in friendly relations with Mr. Perks until he refused to co-operate, and then Mr. Morgan came in. They were told that they could not rely on the Metropolitan District Railway for financial support, and consequently they combined with the Piccadilly and City and the London United Railways.

Other evidence was called in support of this Bill, and the case for the promoters was closed.

Mr. LITTLER, K.C., then opened the case for the Brompton and Piccadilly Circus Railway (new lines) Bill, and said that in connection with his association with the Metropolitan District Railway, Mr. Yerkes had been led to consider how certain railways might be coupled up and be made of real service to the public. The result was that a company was formed with a capital of £5,000, and this had been subscribed partly by Mr. Yerkes, partly in England, and partly by the Old Colony Company, of Boston. £2,000,000 of the amount was subscribed in England. It was not anticipated that this capital would be sufficient for all contemplated schemes, but the company had contracted to supply all capital for the extension of the lines now before the Committee. All additional capital was guaranteed by Messrs. Speyer Bros. on the basis of a commission of 5 per cent. in shares and 1 per cent. in cash. Now that the District Railway was to be converted into an electrical railway for all practical purposes, it became part of the tube group, and by working it as such they would be enabled to have a network of railways from Earl's Court to all parts of London. Mr. Littler proceeded to show in detail the way in which various parts of London would be served by the agreement which had been made for junctions, &c. With regard to the Bill, the total estimated expenditure was £3,827,500, and the total capital and borrowing powers sought were £4,133,000. With regard to the Brompton and Piccadilly Circus Railway itself, that had already been commenced. The tunnel was 12 ft., but should the Committee consider it should be of larger diameter, Mr. Yerkes was willing to enlarge it and bear the loss.

The Committee adjourned.

NEWCASTLE CORPORATION TRAMWAYS.

ON Monday a Select Committee of the House of Lords, presided over by Lord Stanmore, commenced the consideration of the Newcastle-on-Tyne Corporation (Tramways Extension) Bill. Mr. Pember, K.C., Mr. Hans Hamilton, and Mr. Ackworth, were counsel for the promoters. There was a good deal of opposition, amongst the opponents being the Tyneside Tramways and Tramroads Company, who were represented by Mr. Balfour Browne, K.C., Mr. Lewis Coward, K.C., and Mr. E. Shortt.

In opening the case, Mr. PEMBER said the Corporation proposed to extend their tramways along the Union and Welbech Roads to Walker, a distance of about 1½ miles. There would be 5 miles of tramway in Walker, and small extensions into Benwell. With respect to the Walker tramways, the Corporation came before Parliament in consequence of a pledge given. When the Tyneside Tramways and Tramroads Company proposed last year to construct tramways in Walker, they were opposed by the Newcastle Corporation and the District Council of Walker. When the matter was before the House of Commons Committee, he (Mr. Pember) stated that it had been agreed upon between the Newcastle and Walker Councils that tramways should be made in the latter district, and that the Newcastle Corporation would bring forward a scheme this session. The objection of the Tyneside Tramways Company was that if the Bill passed, there was no compulsion on the Newcastle Corporation to construct the tramways. He would point out, however, that it was unusual to have such compulsory powers in such a Bill. Then the Tyneside Company further objected to the period of six years being allowed for the construction of tramways, but in that again there was nothing unusual. Then the company further alleged that a pledge was given that there should be a through route provided under the Bill, and that the Newcastle lines should be carried to within a few yards of the company's lines. He presumed the wish of the company was to have a physical junction with the Newcastle lines so that they might ask for running powers over them, but it was not proposed to give them that. He submitted that the company had no right to be heard at all.

Mr. BALFOUR BROWNE, K.C., contended that the pledge given was that these tramways in Walker should be constructed forthwith, but now all the Bill said was that they should be constructed within six years. He maintained that the promoters ought to be compelled to commence the work at once, and if they did not do so the Tyneside Company should be empowered to construct them at the Corporation's expense.

The COMMITTEE deliberated in private, and decided that the Tyneside Company had a right to be heard; but they dismissed the opposition of a number of inhabitants and manufacturers of Walker, and also the Wallsend Corporation.

Mr. W. CAIL, chairman of the Tramways Committee of the Newcastle Corporation, was then called, and explained in detail the different tramways it was proposed to construct. If the Bill passed, they would be able to proceed with the construction of the tramways forthwith. They hoped to complete the tramways within six months.

In answer to the CHAIRMAN, Mr. HANS HAMILTON said the Newcastle Corporation were willing to be put under an obligation to complete the tramways within a specified period if the period was reasonable.

In reply to questions, WITNESS said, with the exception of one tramway, he thought the whole of the lines in the Bill could be completed within 2½ years. While they would give reasonable facilities for passengers to change from the Tyneside Company's tramways to the Corporation tramways, they could not give running powers to the company in consequence of the rapid service in the town and the crowded state of the streets.

A number of local witnesses were then called in favour of the Bill, and the Committee adjourned.

LEGAL.

BRITISH AND FOREIGN LIGHT RAILWAYS SYNDICATE, LIMITED, AND ORMSKIRK AND SOUTHPORT LIGHT RAILWAYS COMPANY, LIMITED, *v.* THE ELECTRIC TRAMWAYS CONSTRUCTION AND MAINTENANCE COMPANY, LIMITED.

IN the King's Bench Division on Tuesday, before Mr. Justice Bigham, sitting to try commercial causes, a short cause transferred from the Liverpool Registry, in which the British and Foreign Light Railways Syndicate, Limited, and the Ormskirk and Southport Light Railways Company, Limited, of 17, Water Street, Liverpool, sought to recover £3,500 from the Electric Tramways Construction and Maintenance Company, Limited, London, on an alleged contract, was heard. Mr. Pickford, K.C., and Mr. McConochie appeared for the plaintiff companies, and Mr. Hamilton, K.C., and Mr. Ashton Cross for the defendants.

Mr. PICKFORD said the sole question was whether there was or was not a contract between the parties. The facts were that the plaintiffs obtained a provisional order for the construction of a light railway between Ormskirk and Southport, and the defendants, plaintiffs alleged, agreed to purchase from them the benefit of the order for £5,000. The order in question was made by the Light Railway Commissioners under the Light Railway Act, 1896, and was approved by the Board of Trade on February 21st, 1901. It was agreed, plaintiffs said, that £1,000 was to be paid down, £2,500 within one month from January 30th, 1902, and the balance within three months. The matter was arranged by a Mr. Chadwell, an engineer, and plaintiffs, at a meeting of the directors of the syndicate, confirmed the agreement. Plaintiffs said there was a concluded bargain, and they therefore brought the action to recover the £3,500 due. He believed the defence was that there was no concluded bargain, and that the words "subject to contract" in the agreement prevented it being binding on the defendants. He quoted cases bearing on the point, and argued that there was a binding contract.

Mr. HAMILTON, for the defendants, submitted that there was not a binding contract, and also quoted cases in support of his contention. The words "subject to contract," he said, protected the defendants, as no formal contract was drawn up.

After considerable legal argument, his LORDSHIP said the defendants had made a bargain, and wanted to shuffle out of it. The plaintiffs had an order for the construction of a light railway from Ormskirk to Southport to sell, and, in his opinion, the defendants bought it. It was, in his opinion, a perfectly plain contract, and there must be judgment for plaintiffs for £3,500 and costs. Stay of execution was granted for 10 days on the usual terms.

SOUTH LONDON ELECTRIC SUPPLY CORPORATION *v.* BELL.

AT the Lambeth County Court on Tuesday, before his Honour Judge Emden, the hearing of this case, which was to recover £1 3s. 4d. for electric current supplied from August, 1901, to December last, and which had been adjourned from April 16th, was resumed.

Mr. HARGREAVES, who appeared for the corporation, said the Court would remember that, although the amount sued for was small, the point at issue affected some hundreds of cases, besides involving the honour of officials. Briefly, Mr. Bell's defence was that the words "and this agreement shall be operative under any circumstances for a period of not less than three years," were printed on his agreement after it was signed by him.

Mr. WAYRE, printer, stated he printed the agreement produced. There was an order given for 500 copies, but after 100 had been delivered an order came by telephone that an important clause had been omitted. The words "and this agreement, &c.," were then printed on the 400 undelivered copies.

Mr. HARGREAVES: Was the additional printing put on any agreements which had been signed?—Certainly not. The agreements we put the clause on had never left our place.

Mr. CLEMENT, the canvasser who took Mr. Bell's order, and who witnessed his signature, was called. He said he could not swear whether the clause in small print about the three years was or was not there when Mr. Bell put his name to the document.

Mr. HERBERT H. BOYER, secretary of the plaintiff corporation, corroborated Mr. Wayre's evidence. There was no truth in the suggestion that the agreement had been altered after it was signed. The charge which had been made was a most serious accusation against himself, and he most emphatically denied it.

Judge EMDEN said the case was peculiar in several respects. On the one hand, Mr. Bell's tenancy would be up before the expiration of the three years. On the other hand, the plaintiff corporation put in the fittings free, and it would be only reasonable for them to bind the customer for a term. Mr. Bell had already sworn most positively that he read the agreement carefully before signing it.

Miss MAUD BELL, defendant's daughter, stated she witnessed her father's signature, and was absolutely certain the clause about the three years was not on it when he signed. She read the agreement carefully, every word of it.

Judge EMDEN: If I remember rightly, defendant said on the last occasion he discontinued the light because he found gas to be better?—DEFENDANT: That is so. I could get more light from one incandescent than from the whole six of these—16 C.P. they call them.

Judge EMDEN: That is the sole reason you discontinued the supply?—Yes, I could not get any light.

Judge EMDEN said electric light companies had a bad system with respect to agreements, inasmuch as they did not supply a counterpart or a copy to the customer. How was a man to carry all the clauses of a long agreement in his head?

Mr. BOYER re-called, said copies of agreements were supplied if they were asked for.

Judge EMDEN: Why should people have to ask for them? Is your practice the custom of electric light companies?—I believe it is.

Judge EMDEN: Well, it is not a right system of doing business, and the sooner it is altered the better. Clearly, the customer is entitled to a counterpart or copy of his agreement.

After some further discussion, his HONOUR said: I find in the agreement this: "My tenancy expires ——— day of ———." In the present case it was September 29th, 1900. In diamond type underneath there is the clause about the three years. The two are absolutely inconsistent. This is the point: he could not bind himself for three years when his tenancy expired previously. What do you say to that, Mr. Hargreaves?

Mr. HARGREAVES: There is ambiguity there, it must be admitted.

Judge EMDEN: There is more than ambiguity. Have you anything to say on the point, Mr. Boyer?

Mr. BOYER: We hoped he would renew his tenancy.

Judge EMDEN: People do not hope when they sign contracts. This shows the lax way of doing business these electric supply corporations have. I am glad I have not to decide whether the three years' clause was or was not on the agreement when it was signed. I think it was there. But, unfortunately, it is in very much smaller type than the rest of the document, and is in a place where no one would expect to look for such a thing. That was not a proper way to insert such an important clause—the most important if it were valid in the whole agreement. But I hold that it is not valid, as a man cannot bind himself for a longer term than his tenancy. The case must, therefore, be dismissed with costs.

RATTEE *v.* NORWICH ELECTRIC TRAMWAY COMPANY, LIMITED.

THIS case on Tuesday came before Lord Justices Vaughan-Williams, Romer and Mathew in the Court of Appeal. The appeal was by the Tramway Company, who asked for judgment or new trial of an action heard before Mr. Justice Grantham and a special jury at Norwich in February. It raised an important question as to the liability of electric tramway companies for accidents resulting from horses being frightened by the approach of a car which the motor-men had not pulled up to a standstill when signalled to do so by the driver of the horse.

Mr. Witt, K.C., and Mr. F. Low, K.C., appeared for the defendants; Mr. Kemp, K.C., and Mr. Inskip for the plaintiff.

The action was brought by Mr. Daniel E. Rattee, a veterinary surgeon, residing near Norwich, to recover damages for personal injuries caused by the alleged negligence of the defendants' servants. The defence was that the accident was unavoidable, and that the plaintiff was guilty of contributory negligence in not having proper control over his horse. At the trial the jury found for the plaintiff, with £854 damages, to include £104 out-of-pocket expenses. The company appealed, contending that there was no evidence of negligence on the part of the driver of the tramcar, that there had been misdirection on the part of the learned judge, and that the damages were excessive. The facts were, shortly, these: the plaintiff was driving to Norwich on April 27th last year, and when near Eaton, on the Newmarket Road, he saw a tramcar 200 or 300 yards away, approaching him. His horse, though generally very quiet in harness, did not seem to like the car coming towards him, and the plaintiff held up his hand and shouted to the motorman to stop. Instead of doing so, the driver sounded his bell more and more, and the more he sounded it the more frightened did the horse become, until the plaintiff could no longer hold him. The horse and trap collided with the car and the plaintiff was thrown out, and was taken unconscious to the Norwich Hospital, where it was found he had sustained very serious injuries. His front teeth were knocked out, his collar-bone broken, his arm fractured in two places, some ribs smashed and his hand terribly crushed. To his claim for compensation, based on the ground that had the driver stopped the car as he had signalled and called out to him to do, the accident would never have occurred. The company took up the position that having a statutory right to use the road for the purpose of running electric cars on the metals, and having given due notice of the approach of the car by sounding the bell, they were not liable.

COUNSEL having been heard for the company,

Lord Justice VAUGHAN-WILLIAMS said the appeal must be dismissed. The jury found in effect by their verdict that the driver of the tramcar disregarded the signals and the cries of the plaintiff for him to pull up the car, and that in spite of the plaintiff's endeavours to have the car stopped, he nevertheless negligently went on. There was not dispute as to how the accident happened, and the question the Court had to decide was whether the driver in pursuing such a course of conduct rendered the company liable. The company said judgment ought to have been entered for them, and the plaintiff non-suited, because what they did was done within the powers granted them by the Act of Parliament, which authorised the running of the tramcars on these lines. It seemed to him that that contention was altogether wrong. The case of a tramway running on a highway was altogether different to that of a railway. In the old railway case of Reg *v.* Prince, it was laid down that there was an absolute power given to railways to run their trains on their lines, and that such statutory power was not qualified by any implied condition that in the exercise of their statutory powers they must not create a nuisance or interfere with the right of the public to using the adjacent highway. But the plaintiff's case here was not based on an allegation that the tramways were a nuisance or dangerous, but that the accident was caused solely because the driver of the tramcar did not pull up when he was told to do so by the plaintiff. The accident, therefore, was not alleged to have been caused by the using of the tramlines by the defendants, who, in that case, could clearly have sheltered themselves from liability by saying they had statutory powers to use them in this way. The plaintiff said that the accident was caused because the driver did not exercise proper care. The jury agreed with the plaintiff, and there was no reason, in his opinion, why the Court should interfere with their verdict. The appeal failed.

Lord Justices ROMER and MATHEW gave judgment to the same effect. In their opinion there was evidence upon which the jury might reasonably find that the driver of the tramcar was guilty of negligence.

Mr. KEMP asked that the damages which had been paid into Court might be paid out.

Mr. WITT objected, intimating that the question was of such vital importance to all electric tramway companies throughout the kingdom

that he should advice his clients to appeal to test the question whether the statutory powers of a company to run electric trams on highways, covered their liability for accidents of this class or not, in the same way as similar powers granted to railways protected them.

The Court decided that the money must be paid out to the plaintiff, together with the costs of this appeal.

CORRESPONDENCE.

Consulting Engineering as a Profession.

The report of the Committee of the Institution of Electrical Engineers on the visit to Germany in 1901 states that "It might almost be said, in fact, that the entire consulting work of Germany is carried out by two engineers." It would be interesting if some of the members who went on this expedition would furnish more information on this point.

There is one point which you have overlooked in your leading article of your issue of May 31st, 1901, viz:—Why is it not considered against professional etiquette for a consulting engineer to be directly interested in private colleges devoted to the training of electrical engineers? Mr. Wordingham, in his book on "Central Electrical Stations," states that the term consulting engineer "has been indiscrimately used by conscientious engineers, company promoters, contractors' touts, and failures in other branches." As this statement has remained unchallenged for so long, may I suggest that he would be even more correct if he had added another class, viz., touts for private electrical colleges.

Finally, will those engaged in all other branches remain at a disadvantage when trying "to pull the chestnuts out of the fire" with consulting engineers? Many engineers, even those with particularly promising careers before them, seem to have overcome this difficulty by taking offices in Victoria Street. Will this go on indefinitely?

Perplexed.

Tramway Linesmen's Duties.

As a reader of several years' standing of the ELECTRICAL REVIEW, I shall be very glad if you could give in your columns the duties of a linesman in connection with the overhead lines of electric tramways.

I commenced work on electric tramways first as a driller. I then was put to rail-bonding. I was then put to pole erecting, and fitting both span and bracket arms up. From this I was taught wiring, and have been now for several years a foreman over all the above work. At the present time I am linesman, but there seem to be many different duties of a linesman which do not belong to this class.

Linesman.

Electric Wiring Methods of To-day; with Special Reference to Conduit Systems.

We are very greatly interested in Mr. Bathurst's letter *re* the means of cheapening electric installations by the use of only one insulated conductor with an earth return.

This seems to us to be absolutely the most perfect method of wiring if it be carefully carried out, yet it is almost impossible to use it in practice, since almost every supply corporation and insurance company (at all events in London) hold up their hands in horror if such an installation is proposed.

It seems to us that a metal-clad conductor offers the best solution, as this can be easily run, and where required on the surface, no harm can result from it being placed in casing, and it could also be drawn into steel tubing where likely to be damaged. Of course, the contractor should be careful to see that perfect continuity is obtained throughout the armouring, and also from it to earth in as great a number of points as possible.

We know from practical experience in isolated plant installations that such a system is very little more expensive to run than ordinary gas-piping, that there is only one-third the usual liability of leakage, and that a leak of any consequence immediately develops into a short, thereby cutting out the faulty portion. The prime cost of such an installation would probably average not more than 4s. to 5s. per point without fittings.

Could the supply companies be prevailed upon to admit it, we are confident that the use of this system would give a great impetus to electric lighting, more especially on the free wiring (so-called) principle. We should like to see a really reliable metal tube with insulated lining which would not be damaged by a right-angled bend, and in which an uninsulated conductor could be placed with safety. We have experimented with ordinary gas and Simplex tube lined with two or three sheets of oil-impregnated paper, but have found this unreliable at bends, and we also fear that it would be short-lived.

Lawrence & Co.

[A letter from Mr. L. M. Waterhouse is held over until next week, owing to its late arrival.—EDS. ELEC. REV.]

Wood Casings v. Tubing.

Having seen the article entitled "Electrical Wiring Methods" in your recent issue, by Mr. Fred Bathurst, I should like to say that the good old wooden casing days are by no means retired from the electrical world. I should like to point out the good qualities and advantages wood casing has over the tube system.

There is no method of wiring so cheap and simple, or easier to fix; the wires or cables are always separated from each other, and at high voltage are much better separated than having them twisted together in a metal tube. With wood casing painted, far better insulation tests have been obtained than with any metal tube system. I think most electrical engineers will admit that a "laying-in system" is much better than the "threading or drawing through system," there being less risk of damaging the insulation on the cables.

There are many installations erected on the tube system, and if they could be examined there would be found in certain places wires put in, such as a 1/18 nearer 20 or 22 gauge, this being caused by the strain in dragging through the wires.

Respecting mechanical protection in tubing being an advantage over wood casing, this can be applied to casing simply by making a metal cover, which would cover the front and sides, and be strong enough to resist nails driven through. This can be made cheap, and in combination with painted casing, makes a sound, durable, cheap and easy method of wiring.

Another advantage casing has over the tubing system, is that no accessories are required beyond screws, whereas in tubing a contractor must keep dozens of accessories in stock, such as elbows, angles, tees, junction boxes, &c. Fewer tools are required in wood casing, in comparison with tubing.

I wish to say in conclusion that wood casing has stood by the electrical engineer for twenty years, and amongst thousands of installations there are few faults that can be found with it. No system can be made good with bad workmanship.

Installation.

Reason Manufacturing Company, Limited, v. Ernest F. Moy, Limited.

Referring to your report in last week's issue of the REVIEW of the action brought against us by the Reason Company for infringement of their patent fuse box, we desire to call attention to the fact that the decision will not make the slightest difference to our business as manufacturers of fuse boxes.

The learned Judge decided that there was nothing novel in the construction of the single-pole boxes themselves; anybody can make them, and mount two boxes on a board, so long as they do not place them back to back, so that the lids foul one another. No infringement could be suggested if the boxes be mounted so that the lids open outwards, that is, away from each other, or so that the lids of both boxes open in one direction.

As a matter of fact, although we have supplied many thousands of service fuse boxes, it was only by chance that a few dozen were sent out mounted up in the manner complained of as an infringement.

Notice of appeal against the decision has already been given.

Ernest F. Moy, Limited,
E. F. MOY, *Managing Director.*

Much Ado About Nothing.

We wish to call your attention to your report in last week's ELECTRICAL REVIEW of the liquidation of the firm of Mackey, Mackey & Co, Limited, wholesale druggists and manufacturing chemists. You will appreciate the gravity of your publication, which is manifestly intended to convey the impression that the business of Mackey's Electric Lamp Company, Limited, is in liquidation—no other interpretation is consistent with publication in the ELECTRICAL REVIEW. No liquidation of this company's business has been proposed or contemplated, and, without prejudice to any course we may be advised to adopt, we request you to publish a correction and withdrawal in your next issue.

Mackey's Electric Lamp Company, Limited.
R. MULLARD, *Managing Director.*

Tulip Place, New Church Street,
Bermondsey, London, S.E.
April 28th, 1902.

[The above very courteous communication calls for a withdrawal. Forsooth, what shall we withdraw? Our statement was absolutely correct, and our correspondents do not dispute it; the business of Mackey, Mackey and Co. *is* in liquidation, and for the reason that we stated last week. We have said nothing whatever regarding Mackey's Electric Lamp Company, Limited, and what we have not said—well, we cannot very well call back. Perhaps Mr. Mullard will be so good as to compare our little notice with that which appeared in the *London Gazette*, April 22nd, p. 2714. In regard to the reason for the publication in the ELECTRICAL REVIEW, we would add that we do not confine our attentions to the business of lamp companies. Occasionally we think prudent to refer even to manufacturing chemists, especially when we remember that it is not so long ago that Messrs. Mackey, Mackey & Co. were trading as "manufacturing chemists and incandescent lamp manufacturers" at Bermondsey. An explanation to correct a possible wrong impression we are always ready to insert, but our correspondents' letter appears to have been written in haste. We hope, nevertheless, that their statement will fulfil the purpose for which it was intended.—EDS. ELEC. REV.]

An Explanation.

In your last issue you refer, under "Bankruptcy Proceedings," to the application for discharge of Mr. L. J. Lawrence, who traded under the style of Lawrence and Butcher at this address.

While this is perfectly correct, it may lead to some false impression, and we, therefore, beg to state that Mr. L. J. Lawrence is not a member of the present firm, although he occupies a responsible position in it. Since his adjudication he has twice served in South Africa, and during his absence the present firm was formed by his brothers with a view to retaining his customers.

We may say that we have every confidence in the gentleman in question, and that we are convinced that the failure would not have occurred but for circumstances which he was, through illness, unable to control. We can thoroughly rely upon his integrity and business capacity, but feel compelled to write the foregoing in order that our credit may not be endangered under the impression that he is the proprietor of the present firm.

Lawrence & Co.

5, Stafford Street, Abermarle Street, W.
April 28th, 1902.

CENTRAL STATION LOSSES.—Will the author of the article under the above title (ELECTRICAL REVIEW, March 28th, p. 535) kindly communicate his address to us?—EDS. ELEC. REV.

BUSINESS NOTES.

Electrical Wares Exported.

WEEK ENDING APRIL 30TH, 1901.		WEEK ENDING APRIL 29TH, 1902.	
Adelaide	Value £25	Amsterdam	Value £65
Antwerp	14	Auckland	220
Bahia. Telg. mat	51	,, Elec. cable	4,608
Bombay	490	,, Elec. cars	11,061
,, Teleg. mat.	64	Bombay	87
Buenos Ayres	42	,, Teleg. wire	108
Calais	30	Brisbane	147
Cape Town	238	Buenos Ayres	83
,, Teleg. mat.	2,465	,, Teleg. mat.	250
Durban	147	Calcutta	664
,, Teleg. mat.	3,650	Cape Town	126
East London. Teleg. mat.	1,300	,, Teleg. mat.	693
Fremantle	72	Colombo	23
Ghent	120	Copenhagen. Teleg. cable	93
Gibraltar. Teleg. cable	140	Durban	394
Gigon	622	East London	35
Hamburg	166	Gothenburg	298
Hong Kong	231	,, Teleg. wire	23
Kobe. Teleg. cable	9,358	Hamburg	10
Kure. Teleg. cable	2,624	Hong Kong	1,932
Malta	25	Launceston	95
Ostend	500	Malta	105
Perth	210	Odessa	90
Port Elizabeth	103	Osaka	130
Rio Janeiro. Teleg. mat.	244	Perth	4,090
Rotterdam	21	Port Elizabeth	518
St. John, N.B. Teleg. mat.	34	Rangoon	35
St. Petersburg. Teleg. mat.	75	Shanghai	179
Santos	142	Sydney	492
Shanghai	184	Trinidad. Teleg. mat.	102
Singapore	240	Vera Cruz	6,101
Stockholm. Teleg. wire	170		
Sydney	706		
Wellington	2,091		
Yokohama	782		
Total	£27,376	Total	£32,792

Foreign Goods Transhipped.

Cape Town. Elec. mat.	Value £15	Bremen. Elec.lghtg.apprts.	Value £70
		Calcutta. Elec. lghtg. apprts.	64
		Fremantle. Elec. lghtg. plant	4,396
		Total	£4,530

Advertising the American.—Sir Richard Tangye makes some very true and quite timely utterances in the following communication to the *Westminster Gazette*:—"We all know that the 'down-east' Yankee is a master of the art of advertising; for him a finely-illustrated page in the advertising section of a journal has little attraction, or if he adopts it, it is merely as a blind for a far deeper method. He despises the aggravating custom of certain vendors of wonderful remedies who deceive the unwary by giving their announcements the appearance of items of news. The plan adopted by the Trust Boss, or the managing man of some great syndicate, is a very simple one—he just nobbles his Press. Having 'nobbled' it, he proceeds to 'permeate' (what a useful word!) the whole paper, thus ensuring that the gentle reader shall take it in at every pore, until he becomes saturated with the praises of the ingenious advertiser's productions. The system is a very clever one, but has one great disadvantage to the advertiser—it costs him much money. Having thus secured the New World, and finding he has still some wares to spare, he casts his eyes across to England with her open ports and gullible public, and he wonders how he can 'permeate' the Press of this country. But while he muses, his hat on one side, and his finger on the bump of wonder, lo and behold! the English Press does the trick for him without fee or reward. Under protection in America he gets very high prices for his wares, and by manufacturing more than is required for home consumption reduces the cost to a minimum. This surplus he ships to England (and other countries), and the English Press advertises him and his wares 'free, gratis, and for nothing,' while taking care to charge their highest to their own countrymen for their advertisements. If an American firm gets an order for, say, a dozen locomotives, the English Press raises a perfect hullabaloo about it, and asks what the English makers are about. But when the latter get orders for 100 locomotives (which they often do) not a word is said about it.

"Then, again, much was said in the English Press about the inferiority of the English exhibits at the late Paris Exhibition. We were bid to look with wonder and self-abasement at the gigantic exhibits of our German and other competitors. But what are the facts? In the first place, Englishmen had their applications for space ruthlessly cut down, and for political reasons Germany had all she asked for. Germany exhibited enormous masses of machinery, but where is a lot of that machinery now? The makers, to their sorrow, know that it lies with crushing weight upon their hands. But while these things were being made and exhibited to the gaze of an astonished world, English factories were engaged in *bond fide* contracts for machinery of equal importance, they were being enlarged and fitted with modern tools for increased production, and have continued in full work ever since. Compare the industrial position of England at the present moment with that of Germany—prosperity in one case, and utter stagnation in the other. If any evidence were wanted of British prosperity one need only look at the prospectus of Beyer, Peacock & Co., the world-famous firm of locomotive makers.

"So I am come to the conclusion that the Press of this country, which is undoubtedly a wonderful institution, is not omniscient; and I would venture to suggest that, having given the Americans such splendid gratuitous advertisements, they should now do the same for their own countrymen."

Bengal—Nagpur Railway.—The contract for all the switchboards required by the above company in connection with the electrical equipment of the workshops has been placed with Messrs. Kelvin & James White, Limited.

B.I.W. Contracts.—During the last few days the British Insulated Wire Company have received orders from the undermentioned, among others of less importance, viz.:—South Shields Corporation, extensions; Brighton Corporation, 1-in. cable; Salford Corporation, high-tension cables for one year; British Electric Traction Company, cables for Lye tramways; Islington Corporation, high-tension arc lighting cables; Partick, extensions; Guernsey, telephone cable; Coventry, extensions; Blackheath and Greenwich Electric Supply Company, extensions; Great Central Railway, supply of copper wire for one year; Bexhill, extensions; Bristol, eight miles of low-tension power cable; Cleckheaton, extensions.

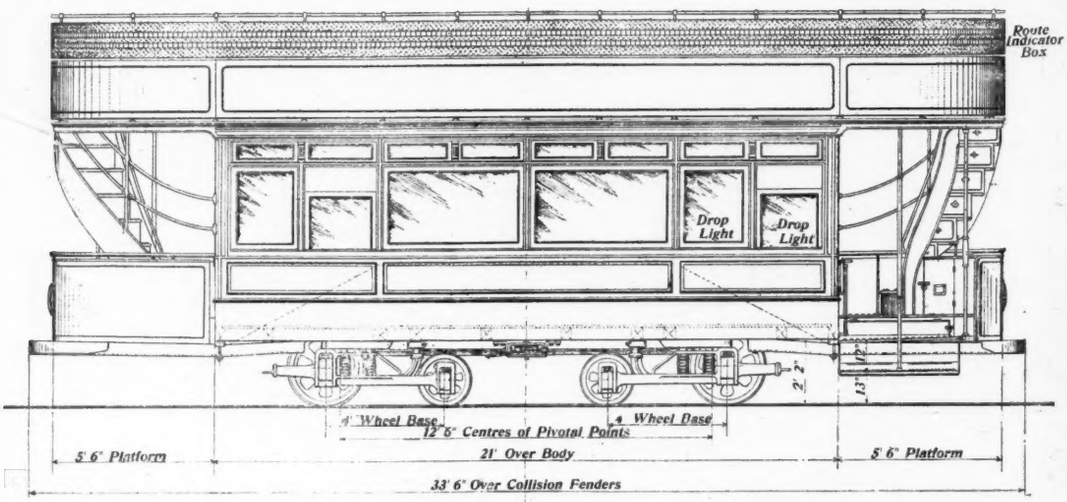
Bristol.—Messrs. Lennards, Limited, of Queen's Road, Clifton, have erected a new pile of buildings for extensions to their boot and leather business, and the electrical installation, which was carried out by a local firm, Messrs. J. H. Winter & Co., is said to be one of the largest ever done in Bristol. Electric lighting, telephones, and electric lifts have been fitted throughout.

"Britain at Work."—This is the title of a magazine to be issued fortnightly by Messrs. Cassell & Co., Limited. The first number gives well illustrated descriptions of the "Building of a Battleship," "Preparing the Land," "The Manufacture of Linen," "How Coal is Brought from the Pit," and "The Manufacture of Tobacco." The magazine is issued at 7d. net, and with the first number is presented a well executed photogravure of the painting by Mr. W. L. Wyllie, A.R.A., "The Birth of a Titan."

Cape Peninsular Lighting Company.—These switchboards, the order for which was lately placed with Messrs. Kelvin and James White, Limited, have now been shipped. They consist of two switchboards each about 40 ft. long, and capable of dealing with the three-phase plant high-tension and low-tension, as well as the continuous current plant being installed.

The Coronation.—We have received from Messrs. Boot and Son, Limited, publishers, of 24, Old Bailey, E.C., a copy of a most interesting little book of about 50 pages (6d.), in which are printed the complete ceremonies and procedures observed at the Coronation of the Kings and Queens of England. We have no doubt that this timely little production will have a host of readers.

The L.C.C. Cars.—In our last issue we referred in some detail to the County Council's contract for electric cars, which had been placed with Messrs. Dick, Kerr & Co. We now give drawings showing the full particulars of the type of car adopted.



London County Council Car.

German Battery Makers' Cutting Prices.—The syndicate of German accumulator makers has been broken up, and already a price-cutting war has set in. Several firms having sent out new lists which show a 20 per cent. reduction in prices.

London, S.W.—Messrs. Cecil Cooper & Co., of South Kensington, have completed the mains, services, and installations at the St. George's Chapel and Committee Rooms at St. George's Workhouse, Fulham Road, for the Board of Guardians. The chapel is lighted by five-light corona fittings, arranged round the 12 columns. Each column is on three switches. The wires are run round the stone capital of these columns in asbestos tubing. The sanctuary lights are concealed, the reflected light only being seen on the altar. No binding of wires had been allowed, each circuit being run in separate casings. There are no joints on the installation, all wires being looped back to the double-pole distribution board. The mains are 19/16 concentric run in 2½-in. cast-iron pipes, draw-in pits, street boxes, Siemens concentric joints.

The Manufacture of Electric Trucks.—We understand that the works which have been put down with British capital in this country by the European McGuire Manufacturing Company, Limited, are in actual operation, manufacturing car trucks, &c. They are situate at Elton Fold, Bury, Lancs., and employ British labour. The company have purchased the rights, designs, and patents of the McGuire Manufacturing Company, of Chicago, and are building their trucks in England, because it is believed to be advantageous to engineers to have trucks built here in order that they may inspect them while in course of construction. The Chicago company claim to be the oldest builders of motor trucks in the United States, and it is from the works there that some trained men have been brought to the works at Elton Fold. Orders for over 700 trucks have been carried out in the City of Philadelphia. There is undoubtedly plenty of room for builders of British-made trucks, just as there has been shown to be scope for new makers of British-made car bodies and motors, and no doubt the McGuire Company will reap a good reward for their enterprise. We have received from the company one of its 1902 catalogues showing some of the many types of trucks they are manufacturing, and giving a list of roads in America on which the McGuire trucks are doing service. The combination snow plough and sweeper, street sprinklers, car heating apparatus, ratchet and elastic brake hangers, also starting and regulating apparatus, and several types of car fenders are shown. The London offices of the company are at 4 and 5, Warwick Court, W.C.

Search Lights for the Coronation.—Having regard to the probable large demand for search lights during the Coronation illuminations, Mr. G. Braulik, of Upper Thames Street, E.C., will hold a large and varied stock of these, which can either be let out on hire or bought outright. He also has a stock of his new flame arc lamps on hand for illumination purposes.

The Tramways Exhibition, 1902.—We have received from the promoters of the Second International Tramways and Light Railways Exhibition (the *Tramway and Railway World*, Amberley House, W.C.), an illustrated brochure which discusses the objects and purpose of the Exhibition which opens on July 1st next, and gives a list of about 140 firms who have already taken space.

What the British Consuls Have to Say.—*Proposed Telegraph to Tabora (German East Africa).*—Mr. Buchanan, Secretary to his Majesty's Embassy at Berlin, in his report on the German colonial estimates for the year 1902, states that the share to be borne by the Colonial Government in carrying the Dar-es-Salaam—Mpapwa telegraph line on to Kilimantinde is estimated at £84,000, while the cost of continuing the line from Kilimantinde to Tabora is to be defrayed exclusively by the Imperial Telegraph Administration. In last year's estimates the Colonial Government's share in the cost of bringing the line to Mpapwa was estimated at £750, but this sum has since been found to be quite inadequate for the purpose, and has had to be considerably exceeded. The Mpapwa telegraph office was opened on November 28th last. The total estimated cost of the extension of the Dar-es-Salaam—Mpapwa telegraph line to Tabora is £38,500, of which £8,400 are included in the colonial estimates as the contribution of the Government of the East African Protectorate, while the remaining £30,100 was to be provided by the Imperial Telegraph Administration. The decision of the Budget Committee to reduce the latter sum to £15,000 has been confirmed, and the expenditure of £8,400 by the East African Protectorate sanctioned. In support of the proposed extension, the Government urged the necessity, for administrative purposes, of establishing telegraphic communication with the interior, as well as the importance of connecting the East African telegraph line with the British Cape to Cairo line.

Electrical Transmission of Power.—Colonel Coëtlogon, his Majesty's Consul at Charleston (U.S. America), in a report received at the Foreign Office on March 15th last, comments on the modern

system of electrical transmission of power and referring to the water-powers of the United States, remarks that good authorities now consider that the Southern States present one of the most attractive fields in the United States for engineering skill, and the number of plants now under construction, or in contemplation, bear witness to the fact that this has been appreciated. Power, he states, can be readily sent from 1 to 10 miles with very little loss, and this renders it possible to construct mills at considerable distances from rapids and falls and yet have all the advantages derived from cheap water-power. During the past few years not less than 40 water-power plants for manufacturing cotton goods, supplying towns with light and street railway power, have been established in Georgia, and the indications are that as many more will be required during the next year or two. The headwaters of the Savannah River, on both the South Carolina and Georgia shores, are expected to furnish some thousands of horse-power that will be needed for manufacturing enterprises within the next 12 months. It has been estimated that in Georgia alone there is probably enough undeveloped water-power now available to serve every mill, factory and railway in the State, and still leave a large surplus over, and this will apply also, in a more or less modified degree, to North and South Carolina, Alabama, and Tennessee. Electrical appliances, Colonel Coëtlogon thinks, will doubtless enable many of these powers to be brought into service.

Electric Light and Tramways in the Havre Consular District.—Vice-Consul Bax, reporting on the trade of Trouville and Deauville, in the Havre Consular district, for the year 1901, states that the work of lighting the quays, chief streets and public places of both Trouville and of Deauville by electric light was begun during the past season. Plans for an electric tramway to serve Trouville, Deauville and Touques have been authorised, and a company has been formed to work it. Another tramway to connect Honfleur, Trouville and eventually Dives is contemplated, but has not yet been sanctioned.

Pigeon Post v. Telegraphic Communication.—Mr. C. H. Harley Moseley, Colonial Secretary of Lagos, in his Blue Book of the Colony for the financial year 1900—1901, remarks that for various reasons of importance to commerce a system of some direct means of communication between Lagos and Forcados was considered a pressing necessity. But the finances of the Colony would not justify undertaking a subsidy of £3,500 a year to connect the two places by cable, and the construction of a land wire would mean an expenditure for building and maintenance that could not at the time be met; therefore proposals were submitted and approved by the Secretary of State for the establishment of a pigeon post between those two places. The training of pigeons was taken in hand by Captain Elgee, and, in spite of the many difficulties to be overcome, he has been so successful in training birds to fly from stations within the Colony and Protectorate, that it is hoped the system will be perfected at no distant date.

The Trieste—Scorcola—Opcina Electric Railway.—Consul H. L. Churchill, in a report on the trade and commerce of Trieste for the year 1901, referring to the railways and other public works, remarks that the electric railway Trieste—Scorcola—Opcina, built by the Oesterreichische Union Elektricität Gesellschaft is to be extended a little over three miles, which will cost about £61,000. This line when complete will connect Trieste with the Karst plateau, and will be opened during the present year. The railway rises to an altitude of nearly 400 yards. Since the introduction into Trieste of the electric tramway, which has replaced the old horse lines, Consul Churchill states that an increase of from 50 to 68 per cent. is shown in the receipts of the Belgian company which works the tramways of Trieste. An electric establishment—"Gesellschaft für Elektrische Industrie"—Consul Churchill reports has been founded at Ragusa (Dalmatia).

Consul Ross in his report on the trade and commerce of the Consular District of Buenos Ayres for the year 1901, states that there is a steadily increasing demand for all manner of electric appliances for domestic use, such as lifts, automatic and otherwise, fans and ventilators, and also for electric tramway rolling stock and installations. All the streets in the centre of the town of Buenos Ayres, Mr. Ross states, are supplied with electric light. They are well lit on ordinary occasions at night, and are brilliantly illuminated at carnivals or on any special anniversary. Many of the private houses and offices are fitted with electric light and fans. There is a complete network of tram lines all over the town, and, he states, all the cars on them will shortly be run entirely by electricity. At present 62 miles are thus worked out of the 268 miles of tram lines, and the conversion from horse to electric traction is going on rapidly. The passengers carried by the electric lines last year numbered 30,088,803; by the horse lines, 95,436,151. Every building used for offices or residential flats of any pretension has an automatic lift of the most modern type running day and night.

Telegraphs in the Argentine Republic.—There are 24,480 miles of telegraph lines in the Argentine Republic, and of these 11,400 miles belong to the Government. The gross revenue from the Government telegraphs in 1899—the last year of which record has been published—Consul Ross states, was £108,333. The telegraph system, he remarks, is far from complete, but is being steadily extended to reach the outlying portions of the Republic.

A grain elevator—worked by electricity—and store capable of containing 130,000 tons of grain is being constructed alongside No. 2 dock at Buenos Ayres by two of the railway companies, and it will be fitted in the most modern style.

Catalogues.—We have received from the Simplex Steel Conduit Company, Limited, of Bucklersbury, E.C., a small price list such as they are circulating to show the suitability of their "Simplex" wiring system for Coronation illumination devices and fittings.

Mr. Arthur Koppel, of Clement's Lane, E.C., has sent us an illustrated circular of his patent electric tramways for industrial factories, mines and contractors' purposes, of which a number are now in operation in different parts of the world. He also makes a speciality of standard gauge electric shunting locomotives and electric mining locomotives for underground working.

Messrs. Holden & Brooke, Limited, have issued a little pamphlet titled "Last Year's Record," in which they give a few selected photographs of work connected with steam-power plant specialities carried out by them during 1901.

The Berliner Telephone Manufacturing Company, of Queen Victoria Street, E.C., have sent us a number of lists of their magneto-generators, bells, automatic inter-communication telephones, twencen telephones, also multiple telephone cable for inter-communication.

A small hanging card is being sent out by the Rankine Patent Feed Water Filter Company, Limited, of Water Street, Liverpool, showing an illustration of their compound-type double filtration. The back of the card gives a list of electrical plants in this and other countries in which the Rankine filters are employed.

Messrs. J. Halden & Co., of 8, Albert Square, Manchester, have sent us a copy of their illustrated list of theodolites, levels, and surveyor's materials. A separate sheet shows their new railway permanent-way gauge invented by Mr. H. Footner for the use of engineers and inspectors requiring an accurate instrument for such work. It consists of a light polished mahogany bar, with steel fittings and countersunk level. The gauge is formed by two rigid metal projections, one of which is fixed, and the other adjustable, fitted with a finely divided scale. The fixed projection, when not in use, may be folded. In obtaining the super-elevation of the rail, a swivel pin is provided, upon which is marked a scale reading to ¼th of an inch. When the pin is not required it may be folded inside the woodwork of the gauge. The adjustable gauge will be found most useful, as it is often required to take accurate gaugings through points and crossings, and on sharp curves where the gauge should be either tight or slack.

Bankruptcy Proceedings.—On May 15th, at Carey Street, the application for discharge of Mr. J. G. M. Hilton, electrician, of Trafalgar Works, Bow Common Lane, London, is to be heard.

Dissolutions and Liquidations. — Creditors of the British Electric Meter Company must send particulars of debts, &c., to the liquidator, Mr. F. S. Springett, 146A, Queen Victoria Street, E.C., by June 10th.

Messrs. D. Wilson, and J. W. and R. Graham (Wilson, Graham and Co., electrical engineers, Faraday Works, Huddersfield), have dissolved partnership. The Messrs. Graham will attend to debts, &c.

Mr. H. E. Abbott, 5, Fenwick Street Liverpool, was on April 8th appointed liquidator, with a committee of inspection, in the Electrical Regulating and Lighting Syndicate, Limited.

The Auto Electro Feed-Water Purifier Company meets at Wolverhampton on May 31st to hear an account of the winding up from the liquidator, Mr. H. P. Smith.

Messrs. A. H. Durtnall and R. Pries (Durtnall & Pries, electrical engineers, 82, Bunhill Row, E.C.), have dissolved partnership. Mr. Pries will continue the business and attend to debts.

The Court has appointed Mr. Frank Hyland, liquidator of the business of Charles Bright & Co.

Notice of release on March 24th, of the liquidator (Mr. P. W. Northey) in the Epstein Electric Accumulator Company, Limited, appeared in the *London Gazette* on 25th ult.

Books Received.—"The Testing Arrangements of the British Fire Prevention Committee." London: The British Fire Prevention Committee, 1902. 2s. 6d.

"Physics for High School Students," by H. S. Carhart and H. N. Chute. Boston: Allyn & Bacon, 1902.

"Science Abstracts," April 25th, No. 52. London: The Fielden Publishing Company, Limited. 2s.

"Dynamos, Alternators and Transformers," by Gisbert Kapp. London: Biggs & Co. 10s. 6d.

"The New Volumes of the Encyclopædia Britannica," Vol. I. (Advance Sheets). London: The *Times*.

Installation Work.—Messrs. C. E. & H. M. Peel, electrical engineers, Swansea, have received instructions from Col. Napier Miles, M.V.O., Malmesbury, to lay down electric generating plant at his mansion house to supply current to some 400 electric lights; the motive power will be oil. They will also instal electric motors for pumping and other domestic purposes. Amongst the work recently carried out by this firm may be mentioned the electric lighting of the new post office at Swansea—400 16-C.P. lamps—also a large factory in the Swansea Valley, where the motive power is water.

Trade Announcements.—Mr. C. W. Webster, of 69, Westgate, Bradford, notifies that he is continuing business as electrical engineer at the above address, and having retired from his old firm of Rhodes & Webster, he has now no further connection with any persons trading under that name. He is open to receive the latest catalogues and net prices from suppliers of electrical goods.

Messrs. Elliott Brothers announce that their London office and showroom have just been removed from 101, St. Martin's Lane, to new premises at 36, Leicester Square, W.C. The telegraphic address and telephone number will remain as heretofore.

Mr. J. Pullar Phibbs, M.I.E.E., informs us that owing to his taking up a position in Messrs. J. Pullar & Sons' works (Pullars

Dyeworks, Perth), he is relinquishing his connection with his Continental firms, Messrs. Geoffroy & Delore, cable manufacturers; Messrs. Bergmann's Electrical Works; Messrs. Carels Frères, Sulzer engine builders; and the High-speed Engine Company, of Liège, Belgium. Mr. Pullar Phibbs's new address will be Muirton Bank, Perth, Scotland.

Messrs. Moores, Farrell & Co., manufacturing electrical engineers, have, owing to increased business, removed to more commodious premises at Mynshull's House, Victoria Street, Manchester, where they will shortly have a large and varied display of electrical fittings, electroliers, &c., brass and copper, and oxydised silver.

The City and Suburban Electric Carriage Company ask that henceforth all letters and other communications be addressed to the head office, Niagara, York Street, Westminster, S.W.

Change of Address.—The British Thomson-Houston Company, Limited, have removed their Irish office from 21, Lincoln Place, Dublin, to Belfast—No. 9, Donegal Square, West.

ELECTRIC LIGHT AND POWER NOTES.

Barnstaple.—The T.C. has instructed the clerk to take steps to raise the loan of £21,000 for electric lighting purposes.

Bath.—The committee appointed to inquire into the matter has drawn up a report which will be submitted to the City Council at their next meeting. In the tender of the Standard Electric Tramways, Limited, the offer is to lease the works for the term of the tramways concession. This concession is in perpetuity, subject to the right of the local authority to purchase at the end of 32 years. In the other tender the offer is to lease till the expiration of the period of the last loan obtained by the authority for the undertaking, but with the provision that the Council may determine the lease at the expiration of 10 years "upon payment of a sum equal to 15 per cent. on the whole of the capital expended upon the undertaking." Under both tenders, the control of capital expended, and the management of the undertaking, would pass out of the hands of the Council. The committee does not think it would be wise for the Council to part with its control and management for so long a period as 32 years, and therefore does not advise the acceptance of the tender of the Standard Electric Tramways, Limited. The other tender provides for the resumption of control by the Council at the expiration of 10 years, but only upon payment of a sum which would almost certainly exceed £20,000, that is at the rate of £2,000 for every year which the company holds the works. Having regard to the increasing returns which the undertaking shows even under the present very adverse conditions, the committee does not think it is possible that in 10 years' time the charge upon the rates would approach any such sum, and therefore recommends that the thanks of the Council be given to the companies for their tenders, but that the Council retains the works under its own control, and that for the remainder of this year the Joint Electric Light Sub-Committee continue to carry on the work of the undertaking and report direct to the authority.

Beverley.—Colonel W. Langton Coke, L.G.B. inspector, has held an inquiry into the application of the Corporation for permission to borrow a sum of £15,000 for the laying down of electric light in the borough.

Canterbury.—The report of the third year's working of the electricity undertaking shows the number of consumers connected to be 343, as against 259 last year, while the number of public lamps connected is 12 arc and 359 incandescent lamps. The revenue account shows a gross surplus for the year of £2,602 6s. 3d., against £1,885 14s. 9d. in 1901. This surplus is applied to repayment of capital, £854 16s. 4d., and interest £1,016 15s. 8d., and leaves, with the balance brought forward last year of £419 10s. 5d., a sum of £1,160 4s. 8d. to be dealt with.

Cardiff.—The L.G.B. has granted the T.C.'s application for power to borrow £21,000 for extensions at the electric lighting works. On Wednesday it transpired that the working profit last year was £1,023, calculated at 7 per cent. return on capital.

Cheshire and Staffordshire.—At a meeting of the Winsford U.D.C. last week, a letter from Messrs. Rowcliffe & Co., solicitors, Manchester, was read, intimating that they intended to apply, on behalf of an influential syndicate, for Parliamentary powers to erect electric generating stations and lay mains for the supply of electricity throughout a district comprising the County of Cheshire and the northern part of Stafford. The chief object of the company was to supply electricity for power purposes. Though they would be prepared to supply local authorities with electricity in bulk for lighting and other purposes within their own areas, at cheaper rates than they could produce it themselves, the company's business would lie in other directions, hitherto practically untouched by local authorities.

Cresswell.—The L.G.B. has held an inquiry into an application of the P.C. for leave to borrow £650 for electric lighting purposes, the latter having agreed with the Bolsover Colliery Company to light the village with 68 lamps of 32 C.P. at the rate of £2 10s. per lamp per annum. The mains will be overhead, 19,000 yards long, and the lamps will be 100 yards apart.

Farnham.—The U.D.C. has assented to Mr. Graver's application for an electric lighting order for Hindhead.

Dartmouth.—The T.C. has decided to seal the contract with the Urban Electric Supply Company to light the town for 10 years at £364 per annum.

Cowes.—The D.C. has resolved that the draft prov. order of the Isle of Wight Electric Light and Power Company and the draft agreement between the Council and the company be approved. The purchase clause gives the Council power to buy the undertaking at the end of 14 years, and the company will, if required by the Council to do so, supply electricity for the public lamps at 3d. per unit.

Devonport.—The electricity supply undertaking was inaugurated by the Corporation on Monday.

East Barnet.—The U.D.C. has adopted a lighting scheme, which includes a dust destructor. The estimated cost is £13,729.

Edinburgh.—The E.L. Committee of the T.C. has resolved that electric energy should be supplied at specially reduced rates for purposes of illumination on the occasion of the Coronation celebrations.

Glasgow.—The arrangement between the Tramways and Lighting Departments of the Corporation, as published in our April 18 issue, were confirmed at the Council meeting on 17th ult. A considerable amount of heat was shown in the debate. In moving the adoption of the minutes, the acting convener of the tramways, Mr. Hugh Alexander, deprecated Bailie Maclay's reference to his department in moving the adoption of the joint minute. They had superfluous power, as he, Bailie Maclay, called it, because they contemplated running 600 to 800 cars when the service was complete, *i.e.*, when the extensions to Clydebank, Paisley Boundary, &c., were finished. At present, they had some 400 cars running, and it would be some five years at least before the maximum power could be required. The agreement between the two departments would be for three years. The two departments were mutually helping one another; for the lighting department to meet the next winter's demand, would require to spend some £30,000, so that he was of opinion that to speak thus was to take advantage of the tramways department. Another councillor moved that an inquiry should be instituted on the point why there were two departments when there was no necessity for more than one. This motion was seconded, but was later withdrawn on account of there being no time to spare, as next winter's arrangements must be completed at once.—Bailie Stevenson supported the minutes, and pointed out that the Lighting Committee were paying dearly for the current at 1½d. per unit. He was sorry these minutes exposed gross mismanagement in the tramways department. "Why," he asked, "was this enormous amount of machinery in excess of requirements, amounting to £250,000, installed?" Bailie Stevenson suggested that an inquiry into the whole working and position of the two departments should be held, and notice was given to this effect.—Mr. Burt considered the arrangement very fair to both departments, and, after further discussion, the minutes were adopted.

Kingston-on-Thames.—The Corporation has decided to proceed with its electric light extensions as approved by the Local Government Board in March, 1901, in spite of the adverse vote and criticism at the recent ratepayers' meeting. At the Council meeting on Tuesday evening, Mr. J. E. Edgcome, the borough electrical engineer, was invited to explain the position of affairs, though it should be said that he was not appointed until after the works were started. Mr. Edgcome said that it was only fair to Mr. A. H. Preece to remind the Council that the system which he originally advised—low-tension alternators—was perfectly proper under the then existing Board of Trade regulations, so that it ought not to be put abroad that he had advised the Corporation wrongly. At the same meeting it was reported that during the last six months an economy of £800 had been effected at the works by the introduction of an economiser and a condenser, aided by the decreased cost of coal.

The Corporation are now prepared to assist consumers in wiring the premises. The work may be done by any firm, subject to the approval of details by the Lighting Committee. Repayment can extend over five years at a charge of 5 per cent. on the outlay.

King William's Town, Cape Colony.—All the shares of the newly-formed local electric lighting company have been taken up.

Lighting of Hotel Metropole, Dublin.—Last week, before Mr. Justice Madden and a special jury, the case of Edmundson's Furnishing and Engineering Company, Limited, *v.* Metropole Hotels Company, Limited, was concluded. The plaintiffs sought to recover the sum of £253 12s. 6d. for goods sold and delivered to the defendant company, for work and labour done, and electric lamps and energy supplied to defendants' hotel. An agreement dated March 15th, 1900, was relied on by the defendants, by which it was alleged that the plaintiffs had agreed to carry out the work for the sum of £123 10s., which they paid to the plaintiffs. For repairs to restaurant sign, cigar depôt sign, and lift lights, the defendants paid into Court the sum of £12 14s., and they also lodged £30 to cover any other claim the plaintiffs might have. The jury found for the plaintiffs for £35 over and above the amount £30 lodged in Court.

Market Drayton.—The Parish Council has cordially approved of the application of a local company for electric lighting powers.

Llangollen.—The U.D.C. has resolved to approve of the agreement with Mr. Bremner Smith, of Oswestry, for the supply of electricity in the district. The agreement provides that Mr. Smith shall pay the cost of procuring the prov. order and 2 per cent. per annum on the net profits; that the charge for energy for public lighting shall be 3d. per unit, certain streets to be lighted with electricity; and that the Council shall have the option of purchase after 10 years at intervals of five years.

London.—Woolwich.—The L.C.C. has granted the application of the B.C. for a loan of £5,600 for the purchase of the Eltham portion of the works of the Blackheath and Greenwich District Electric Light Company, Limited.

The B.C., on the report of Mr. Spencer Hawes, has resolved that the purchase price of the Eltham portion of the Blackheath and Greenwich Electric Light Company's undertaking shall be £5,600, which the company agree to. The capital expenditure is agreed at £2,100, and the balance is computed on the value of work already done at Eltham.

Manchester.—A meeting of the Electricity Committee of the City Council was held last week, and the annual estimates considered. They showed on revenue account a probable expenditure of £175,459, as against anticipated receipts amounting to £166,447, leaving a balance of £9,012 as estimated loss, which loss it is proposed to meet out of the reserve fund. Last year's working on revenue account showed a surplus balance of £6,300 which has been carried to the reserve fund. During the year ended March 31st, 1903, it is estimated that £875,799 will be expended on capital account, including £21,000 at Dickinson Street, £55,394 at Bloom Street, £463,705 at Stuart Street, £211,295 upon distributing stations, and £119,400 on mains. The estimated loss on the working of the department is principally caused by the great expenditure of capital during the past year at the Stuart Street works, the 20 odd sub-stations, and the enormous number of cables required. The expenditure of the department on capital account this year has been between £700,000 and £800,000. Provision of electricity for the tramways has, of course, caused the outlay of great sums. It follows that a large sum is required to pay interest and sinking fund, the amount in this respect reaching £70,000.

South Wales.—A joint meeting of sub-committees of the Neath and Aberavon District Councils was held last week, when the question of supplying the district with electrical power for lighting and other purposes was discussed. Mr. Edmund Hill, manager of the South Wales Electrical Power Distribution Company, was present, and the committees agreed to recommend to their respective councils that energy should be supplied by this company.

Spain.—A large plant is being put down by La Compania Union Industrial Minera, of Linares, to utilise the water-power of the river Guadalquiver, at Batan de da Fuente, in the generation of electrical energy for lighting and power purposes at Villa del Rid, Canete, Marmolejo, Montoro, and Bugalance. The generating plant will comprise three large Schuckert three-phase alternators, driven by three 250-H.P. turbines.

Stirling.—The Lighting Committee, not content with lighting the main thoroughfares with arc lamps, is now invading the side streets, which were formerly given over to the mercy of the gas company, and is giving a very superior illumination at practically the same cost as that of the old light. The system adopted is that of the Improved Electric Glow Lamp Company, and such good results have been obtained, that Mr. Hanson and his staff will probably be kept busy through the summer, converting the remaining gas street lamps.

Swindon.—The Board of Guardians has resolved that Mr. G. R. Peers, electrical engineer, of Manchester, be engaged at a fee of £10 guineas to advise as to the advisability of lighting the workhouse by electricity.

Tynemouth.—The T.C. has resolved to apply for sanction to borrow £8,000 owing to the extensions now necessary at the electric power station, in addition to the £23,000 already applied for.

Wrexham.—Attention having been drawn to the necessity for the removal of certain lengths of lead-covered cable in the lighting system of the Wrexham Corporation, the St. Helens Cable Company, who supplied the cables, have written to the Press stating the facts of the case. It appears that the lead covering of the cables in places became damaged by electrolysis caused through the faulty suspension of the arc lamps, for which the company say they were not responsible. They, however, agreed to take out about £300 worth of the damaged cable, and are replacing the damaged lengths by their non-lead covered patent dialite cable, with the approval of the consulting engineer.

ELECTRIC TRACTION NOTES.

Beckenham.—The U.D.C. is circularising public bodies around London with a view to amending the Standing Order which provides for two-thirds consent in cases of tramway Bills, in order that hereafter the consent of all authorities concerned should be necessary.

Bray.—The U.D.C., on 21st ult., approved of the project of the General Electric Company of Ireland, for an electric tramway system in Bray.

Brooklyn: Battery Traction to be Tried.—The following extracts are taken from an interesting article which appeared last month in the columns of our trans-Atlantic namesake:—"It is stated in the newspapers that the Brooklyn Rapid Transit Company is making experiments with a view to devising a system of storage-battery traction for its vast network of lines in and about the borough of Brooklyn. Popular agitation against overhead wires has reached a point such that the municipal government is expected shortly to order the removal of the trolley wires from the streets of that borough. The cost of installing a system of open-slot conduits on the lines of this company, such as are used on the lines of the Metropolitan Street Railway Company in Manhattan, would entail an expense of nearly $25,000,000. It is believed that storage-battery cars can be installed for a much less sum than this. It is greatly to be hoped that the experiments will be successful. A catalogue of the attempts to operate storage-battery street cars in the United States alone would more than fill this column, yet to-day there is in operation in the United States only a single line of storage-battery cars—that doing crosstown service in Thirty-fourth Street in Manhattan and, so far as is known outside the Metropolitan Company, still working on a somewhat experimental basis. What may be done by new types of battery recently described and not yet in service remains to be seen, but all indications are hopeful and point toward the probable success of street cars equipped with the new type of cells. The experiments in Brooklyn will be watched with the greatest interest by the whole electric railway fraternity."

Calcutta.—*Indian Engineering* for March 29th contained the following interesting note on the electric tramway system of Calcutta:—"An ignorant fear appears to have possessed some people in Calcutta that the overhead wire system of electric traction is a highly dangerous one and that it should be replaced by the conduit system. Nothing could be more absurd. The conduit system is perfectly unsuited to a city like Calcutta, where the subsoil water is so near the upper crust. The conduit system was first tried in Madras, where the conditions are similar to those in Calcutta, and failed. The overhead system, on the contrary, has succeeded both in Madras and Colombo, and, being perfectly safe, is extending in all directions. Thanks to the energy and perseverance of Mr. Martyn Wells, the managing agent of the Calcutta Tramways Company, the electric service was inaugurated on the Kidderpore—Maidan section on Thursday."

Cardiff.—Major Druitt and Mr. Trotter made a B. of T. inspection of certain sections of the electric tramways on Tuesday last week. The opening ceremony took place yesterday.

Cheltenham.—The Light Railway Commissioners will hold an inquiry at Cheltenham on Thursday, May 15th, as to whether the promoter, Mr. T. Nevins, of the existing Cheltenham and District Light Railway, should be allowed to extend his line to Charlton Kings and Leckhampton, about seven miles in length, mostly double line. Mr. Edward Dodd, A.M.I.C.E., of Dodd and Dodd, civil engineers, Birmingham, prepared the necessary Parliamentary plans and estimates, and will give evidence at the inquiry in support of the extensions.

Germany: Electric Motor Tricycles.—For some time past the Bavarian Postal authorities at Munich have been using an electric motor tricycle for the collection of letters from the street letter boxes in that town. The trials have been so successful that a second machine has been ordered for the transport of mails between the G.P.O. and the railway station in Munich. It has also been decided to put down a plant at G.P.O., from which the accumulators of the machines can be re-charged.

Italy: Electric Cabs.—The municipal authorities of Milan have just granted licenses for 15 electric motor cabs to ply for hire in the city.

London to Dover.—An evening paper says that the proposal for a Kentish electric railway from London to Dover includes branch lines to run through the Isle of Thanet to Ramsgate and Margate on the one hand, and Folkestone on the other, which would be connected with the main line.

Manchester.—The Tramways and Lighting Committee of the Moss Side U.D.C. have received a request from the general manager of the Manchester Corporation Tramways, asking the Council to consent to an arrangement whereby the Carriage Company might work the tramways in Moss Side till the completion of the electrical equipment in November next. The Council, at its meeting, consented to the application of the Corporation.

Mersey Railway.—It is reported that a shipment of power machinery for use in working the Mersey Railway, when converted to electrical traction, has been made from the Westinghouse Company's works at Pittsburg. The machinery is said to comprise two 2,000-H.P. cross-compound engines, and two 1,200-KW. generators, to be coupled direct.

Merthyr Tydfil.—The Urban Council proposes to apply for extension of time for the completion of the Brecon light railway.

Morley.—The Light Railway Commissioners have given consent to the Morley (extension) tramway scheme, and this enables the B.E.T. Company to proceed at once with the laying of an extensive undertaking for Morley and district.

Northampton.—At a special meeting of the T.C. on Monday it was unanimously decided to replace the present system of horse trams by electric traction at a cost of £120,000.

Shoeburyness.—The B.E.T. Company's representative is to have an interview with the U.D.C. in regard to their proposed light railway scheme.

Staffordshire.—The B.E.T. Company have decided, from the first of the present month, to reduce the fares to the extent of 33⅓ per cent. on their electric system between Wednesbury and Walsall, and Darlaston and Walsall. Instead of there being three stages on each of these journeys, there will from this date only be two.

Sunderland.—The B. of T. has granted a prov. order to the Corporation for two slight extensions of their tramway system. The first is in connection with a line which was sanctioned in the original Act to be laid to Fulwell, a rural township closely adjacent to Sunderland, and the present order sanctions a deviation from the intended line along Fulwell Road into Gladstone Street and Ravensworth Terrace, which is very much wider at its entrance into Roker Avenue (where the Fulwell line will join the Roker section) than is Fulwell Road. A much wider sweep will be possible in this way than would have been the case if the line had been taken straight along Fulwell Road. The second tramway that the order sanctions is one to Pallion about half a mile long.

Spain.—La Compania Iberica de Electricidad Thomson-Houston, of Bilbao, has secured a contract to convert the horse tramways in the town of Zaragoza into electric lines.

A meeting of the shareholders of the Compania de los Ferrocarelles de Medina del Campo, Zamora, Orense and Vigo is about to be held to decide as to whether electric traction shall be adopted on the company's lines in Galicia.

Whitewell and Belfast.—At a meeting of the Law Committee of the Belfast Council on Saturday it was resolved that the Council should be recommended to pass a resolution offering to the Cavehill and Whitewell Tramway Company terms similar to those offered by the B.E.T.C., and to defray the costs incurred by them in promoting their Bill, undertaking to promote a Bill to confirm these objects.

Wolverhampton.—Our local correspondent says:—"Contrary to general expectation, Colonel H. E. Yorke, R.E., has visited the town for the purpose of making, on behalf of the Board of Trade, an official inspection, of the now completed tramway track from Bilston Street to Coleman Street beyond the Exhibition. A car was got ready at 9.40 in the morning, and immediately after it was boarded by the inspector, the town clerk (Mr. Horatio Brevitt), Alderman Craddock (manager of the Tramways Committee *pro tem*), and representatives of the Corporation, also Mr. G. F. Brown (inventor of the Lorain surface contact system of electric traction), and representatives of the Lorain Company. The car was run along Bilston Street and Piper's Row, into Victoria Square, where a stoppage was made for the Colonel to take observations. Subsequently the car was driven along Lichfield Street, down Darlington Street, along Waterloo Road, and thence down Newhampton Road to Coleman Street. No hitch occurred. The return journey was equally satisfactory, the steep inclines in Newhampton Road and Darlington Street presenting no difficulty. In the middle of the latter street the Colonel ordered a stoppage in order to inspect the track, and on reaching the depôt he went over Bilston Road route, which he inspected some months ago. As a result of his visit, the Colonel gave provisional permission for the tram service from the centre of the borough to Coleman Street to commence at once if the authorities thought fit. As a matter of fact, a regular service of cars was not started, nor was money taken until Wednesday. The interval was employed in instructing motormen and such like."

TELEGRAPH AND TELEPHONE NOTES

Belfast Telephones.—The National Telephone Company has refused to reduce its rates in Belfast to the standard of Glasgow Corporation, and doubts the power of the Corporation to refuse an extension of its licence. The company declines the proposals of the Council.

Belgium.—The Bell Telephone Manufacturing Company, of Antwerp, reports a profit of £8,140 for the year 1901.

Dutch-German Cable Scheme.—Reuter's correspondent at the Hague states that at the Bureau of the Second Chamber of the States General, the Telegraphic Convention with Germany providing for a joint subsidy for telegraph cables to the Dutch Colonies in East Asia was welcomed as a means of diminishing the dependence of Holland on British companies, but on the other hand, it met with opposition, owing to the fear that the convention might unduly subordinate Dutch interests to those of Germany.

Underground Telegraph Wires.—At the Middlesbrough Chamber of Commerce last week, a letter was read from Colonel S. A. Sadler, M.P., enclosing one received from the Postmaster-General intimating that the probable route of the suggested extension to Newcastle of the underground telegraph line from London would branch off to Manchester at Warrington from the proposed main underground line to the North. The branch would be carried on to Leeds and thence in a general northerly direction to Newcastle. It was reported that the Post Office were dredging a trench across the Tees for the purpose of laying a cable, and it was hoped that the work would be completed shortly.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Latakia-Cyprus	June 20, 1899	
Alexandria-Laruaca	Jan. 19, 1902	
Cayenne-Pinheiro	March 8, 1902	April 24.
Zanzibar-Mombassa	March 13, 1902	April 16.
Suakin-Djedda	April 16, 1902	April 25.
Landlines:—		
"*Via* Hanekin" on Persian territory	Feb. 24, 1900	
Communication with Baranquilla and Cartagena	Dec. 8, 1900	
Guanta-Barcelona	March 17, 1902	
Berlin-Versovic	March 31, 1902	
Barcelona-Ciudad Bolivar	March 6, 1902	
Puerto Plata and San Domingo	April 26, 1902	

Wireless Telegraphy.—The Berlin correspondent of the *Standard* says that Germany, it is stated, has not made any proposals to the Powers for restricting the use of any systems of wireless telegraphy; but she has invited England, the United States, France and Russia—the countries most interested in the matter—to enter into an International Agreement with her preventing any single system of wireless telegraphy securing a monopoly. England is as yet the only Power that has responded to the invitation in the affirmative, but it is confidently expected that the other Powers will do so shortly. Should favourable answers be received, it will be possible to draw up a common programme for further negotiations.

The Lisbon correspondent of the same paper learns that the Portuguese Government has adopted the Slaby-Arco system of wireless telegraphy. Herr Loeske, the engineer sent there by the General Society of Electricity, of Berlin, is superintending the erection of a wireless telegraph station on this system at Cascaes, near the entrance to the Tagus, which will be put in communication with another station at Lisbon, and with some of the ships of the Navy. The Naval authorities are also making experiments with a system of wireless telegraph invented by Senhor Gago Coutinho, a Portuguese electrician.

Tests of the Fessenden system of wireless telegraphy have been made in New York, between stations 50 miles apart, in the presence of Brigadier-General Greely, chief of the Army Signal Corps, and other military and naval officers, and have been most successful, according to the correspondent of the *Daily Telegraph*.

The *Chronicle's* Rotterdam correspondent says that on Monday, at the invitation of Mr. Marconi, Ministers and other high authorities witnessed a demonstration of wireless telegraphy off Scheveningen.

The Canadian steamers of the Allan line are being fitted with Marconi instruments. The *Parisian*, which sailed on April 17th, and the *Tunistan*, which sailed on April 24th, each carried Marconi apparatus. The *Pretorian*, which is billed to sail on May 1st, and the *Ionian* on May 15th, will likewise carry wireless telegraphic apparatus.

CONTRACTS OPEN AND CLOSED.

OPEN.

Aberdeen.—May 7th. A 20-ton electrical overhead crane for the Dee Village electricity works. See "Official Notices" April 11th.

Barrow-in-Furness.—May 7th. Arc lamps, columns, switch-pillars and sundry materials for the Corporation. See "Official Notices" April 18th.

Bedford.—May 17th. Fuel economisers for Corporation. See "Official Notices" April 25th.

Brighton.—May 12th. Boundary wall and extensions to the tramways car sheds for the Corporation. See "Official Notices" to-day.

Bury.—Jet condenser and pumps for the electricity works. See "Official Notices" to-day.

Bury.—May 8th. Tramway feeders, conduits, and street-work for the Corporation. See "Official Notices" April 18th.

Christiania.—May 7th. H.M. Consul-General at Christiania reports that tenders to the Norwegian State Telegraphs for the supply of post-hooks, insulators, top covers, top plates, and telegraph wire can be received by the Telegraph Directors up to noon on Wednesday, May 7th.

Cleckheaton.—May 3rd. Direct current motors for the U.D.C. See "Official Notices" April 18th.

Dartford.—May 10th. 300-KW. steam dynamo, piping, and switchboard instruments; Lancashire boiler, feed pump, &c. See "Official Notices" April 25th.

Dublin.—May 13th. Tenders are being invited by the Lighting Committee for the construction of a cast-iron subway under the Grand Canal Dock near the Victoria Bridge in connection with the municipal electricity supply undertaking.

Erith.—May 5th. U.D.C. wants offers for "Free" wiring. See "Official Notices" April 25th.

Fulham.—May 5th. One 600-KW. two-phase steam alternator, or Parsons turbo-alternator for the electricity works. See "Official Notices" April 18th.

Glasgow.—May 3rd. Electricity meters for one year for the Corporation. See "Official Notices" April 25th.

Glasgow.—May 5th. Motor-driven boosters and switching apparatus for the electricity department. See "Official Notices" April 25th.

Halesowen.—May 21st. The Council wants offers for taking over its electric lighting and light railway powers. See "Official Notices" to-day.

Ilford.—May 13th. Three 10-H.P. electric motors for the U.D.C. electricity department. See "Official Notices" to-day.

London.—May 8th. The L.C.C. wants tenders for electric lighting of the Euston Road fire station. See "Official Notices" April 18th and 25th.

London, S.W.—July 31st. The War Office wants tenders for self-propelled lorry (oil). See "Official Notices" April 25th.

Newport (Salop).—May 7th. The U.D.C. wants tenders for lighting the district by gas, electricity or other means. Surveyor, Mr. A. Massey, Council Offices.

Oldham.—May 6th. Switchboards (lighting and traction). See "Official Notices" April 11th.

Roumania.—May 31st. Tenders are being invited until May 31st by the municipal authorities of Calarashi—Stirbeiu for the concession for the electric lighting of the town during a period of 35 years.

Swansea.—May 10th. Installation for the Free Library, art schools and gallery for the Corporation. See "Official Notices" to-day.

Swindon.—May 14th. Free wiring proposals for the Corporation. See "Official Notices" to-day.

Swindon.—May 19th. 252 accumulator cells and accessories for the Corporation electricity works. See "Official Notices" to-day.

Sydney.—May 7th. Messrs. Preece & Cardew, on behalf of the Municipal Council, invite tenders for equipment of electricity works and sub-stations. Water-tube boilers, three-phase steam alternators, battery, motor-generators, stationary transformers, switchboards, &c. See "Official Notices" March 21st.

Wallasey.—May 17th. The U.D.C. invites tenders for the maintenance of the electric installation on their steamers for a period of 12 months from July 1st next. H. W. Cook, Clerk, Public Offices, Egremont, Cheshire.

West Ham.—May 13th. Steel chimneys, fans and engines for induced draught, economisers, &c., for the electricity works. See "Official Notices" to-day.

Woolwich.—The M.B.C. wants tenders for a 70 actual horse-power motor, to be worked in connection with the hydraulic plant at the electric lighting works, at an estimated cost of £350, and for 10,000 pairs of carbons at an estimated cost of £62.

Wrexham.—May 3rd. Engine room stores, cables, joint boxes, lamps, carbons, &c., for electricity department. See "Official Notices" April 25th.

CLOSED.

Bristol.—The following is a list of the firms who tendered for the supply of power cables for the Corporation electrical department (Mr. H. Faraday Proctor, city electrical engineer):—The British Insulated Wire Company (accepted); Siemens Bros. & Co.; The Telegraph Manufacturing Company, Limited; The St. Helens Cable Company; Johnson & Phillips; W. T. Henley, Limited; Western Electric Company; W. & T. Glover & Co.; Callender's Cable and Construction Company.

Glasgow.—The Corporation has accepted the tender of the British Westinghouse Company for switchboard extensions at the tramways sub-stations for the sum of £2,309. There was a cheaper price, but the firm quoting withdrew their tender as they had not inspected the proposed sites.

Hull.—The Electric Lighting Committee has accepted the tender of Messrs. Thornton & Crebbins, Bradford, for pipe work at the Sculcoates Lane Station, the price being £3,312.

Kingston-on-Thames.—The Corporation has ordered 35 arc-lamp standards from Messrs. Macfarlane & Co., at £11 2s. 9d. each, and has accepted the tender of Messrs. Babcock & Wilcox for two chain grate stokers at £515. Two miles of arc lighting cable at £70 7s. 6d. per mile, have been ordered from Henley's.

Llandudno.—The contract for extension of the electricity works has been given to Mr. Evan Hughes at £2,060.

Oban.—The T.C. has confirmed the Lighting Committee's decision to accept the following tenders for the electric lighting scheme:—

Steam pipes, &c.—Messrs. Babcock & Wilcox	£871 0 0
Balancer transformers.—Messrs. Bertram Thomas	649 0 0
Storage Batteries.—British Power Traction and Lighting Company	899 14 0
Switchboard.—Messrs. Bertram Thomas	710 0 0
Arc lamps.—Messrs. Oliver & Co., London	333 0 0
Cable work.—St. Helens Cable Company	2,888 13 4
Travelling crane.—Messrs. J. Carrick & Son, Limited	116 0 0

The road work is to be undertaken by the Council, and the engineers are authorised to order from the makers the necessary conduits and cast-iron work. Mr. Plunkett is the resident engineer.

Schmidt Superheaters.—Within the last few weeks Messrs. Easton & Co., Limited, have received orders for Schmidt superheaters from Messrs. Tangyes, Limited, of Birmingham, Messrs. Belliss & Morcom, of the same city, and Messrs Willans and Robinson, of Rugby.

Warrington.—The contract for the traction switchboard and extension on main switchboard here has been placed with Messrs. Kelvin & James White, Limited.

FORTHCOMING EVENTS.

Saturday, May 3rd.—At 2 p.m. Institution of Electrical Engineers (Students' Section). Visit to the Deptford generating station of the London Electric Supply Corporation, Limited.

Monday May 5th.—At 7.30 p.m. Society of Engineers. Meeting in the Royal United Service Institution, Whitehall. Paper on "Recent Blast Furnace Practice," by Mr. B. D. Healey.

Wednesday, May 7th.—At 7.30 p.m. Institution of Electrical Engineers (Students' Section). Meeting at 28, Victoria Street, Westminster. Paper on "Electric Light and Power Cables," by Mr. T. H. Langford, student.

Thursday, May 8th.—At 8 p.m. The Institution of Electrical Engineers. Meeting at the Society of Arts, John Street, Adelphi, W.C. Conclusion of discussion on "Form of Model General Conditions, &c."

Friday, May 9th.—At 7.30 p.m. Institution of Civil Engineers. Students' annual dinner at Restaurant Frascati.

Saturday, May 10th.—At 10 a.m. Institution of Junior Engineers. Visit to the Great Eastern Railway Works, Stratford.

At 7.30 p.m.—Electrical Engineers R.E. (Volunteers) Cycling Club. Bohemian Concert at headquarters, Regency Street, S.W.

THE INSTITUTION OF ELECTRICAL ENGINEERS AND ELECTRICAL LEGISLATION.

THE following is a copy of the resolutions recently presented by a Committee of the Institution appointed to inquire into matters connected with the national position in respect of electrical development:—

Resolutions Passed by the Committee at its Meeting on Tuesday, March 25th, 1902.

1. That, notwithstanding that our countrymen have been among the first in inventive genius in electrical science, its development in the United Kingdom is in a backward condition, as compared with other countries, in respect of practical application to the industrial and social requirements of the nation.

2. That the cause of such backwardness is largely due to the conditions under which the electrical industry has been carried on in this country, and especially to the restrictive character of the legislation governing the initiation and development of electric power and traction undertakings, and the powers of obstruction granted to local authorities.

3. That local boundaries have usually no reference whatever to the needs of the community in regard to electric supply and traction; that the selection of suitable areas should be dealt with on the basis of economic principles and industrial demands; and that this has been found to apply also to gas, water, and sanitary engineering.

4. That the development of electric power and traction undertakings offers the most favourable means of relieving congested centres, and of thus contributing towards the settlement of the housing question.

5. That it is expedient, in the national interests, that the Electric Lighting Acts, 1882—8, the Tramways Act, 1870, and the Standing Orders relating to special Acts for tramways, should be amended, in so far as they enable local authorities to veto or delay the carrying out of electric supply and traction projects of which the utility can be shown; and that effect should be given to the

recommendations of the Joint Select Committee of Parliament, 1898, on "Electrical Energy—Generating Stations and Supply."

6. That excessive time is occupied and expense incurred in obtaining authority to carry out electrical undertakings, and that important and growing industries are thereby checked.

7. That while this Committee fully recognises the ability of the technical officials of the Government departments concerned, it is of opinion that the staffs of those departments, as at present existing, are wholly inadequate having regard to the great industrial interests involved; that it is essential that these departments should be put into a position enabling them to keep in touch with all developments in engineering matters, both in this country and abroad, and that a sufficient sum should be provided annually by Government to enable them to employ and pay a proper staff for such purposes.

8. That the adjustment of departmental regulations to engineering development should not be delayed until the industrial interests concerned are seriously hampered, and that, with a view to preventing any such delay, the Institution of Electrical Engineers should be willing to take part in revising such regulations from time to time.

9. That this Committee recommends that the Institution should memorialise the Prime Minister to receive a deputation for the purpose of urging the removal of the present disabilities and restrictions which prevent electrical engineering from making the progress that the national interests demand, and attaining at least the same level as in America, Germany, and other industrial countries.

We shall probably deal with the above matters in our next issue.

NOTES.

The I.E.E. President.—Mr. James Swinburne has been nominated President of the Institution of Electrical Engineers for the next session. We tender our hearty congratulations both to the new President and to the Institution. Mr. Swinburne's name is quite well known to all readers of the ELECTRICAL REVIEW. The authoritative position he holds in the science and industry of electrical engineering eminently fits him for the occupation of the Presidential chair of the representative Institution of so important and flourishing a profession.

The Wolverhampton Exhibition.—As the Glasgow Exhibition of last year was undoubtedly of great value in bringing before the notice of the manufacturers in the North the manifold advantages of the innumerable applications of electricity, especially the superiority of electrical driving, we have every hope that the same good object will be served in this and many other uses of electrical energy in and around Staffordshire by the enterprise of Wolverhampton. The scope of the Exhibition, which was formally opened yesterday, may be seen in our other pages, and we trust that the electro-technical and general engineering industries of this country, and the trade and progress of the town which was once proudly termed the "Metropolis of the Iron and Coal Trades of South Staffordshire," may derive mutual benefit from this admirable undertaking.

Institution of Electrical Engineers.—The following is the list of nominations for the Council for 1902-3, presented at the meeting on Thursday last:—

For the Office of President.—James Swinburne.

For the Office of Vice-President.—Remaining in office: Major P. Cardew, S. Z. de Ferranti, John Gavey. New nomination: Prof. O. Lodge, F.R.S.

As Members of Council.—Remaining in office: H. H. Cunynghame, C.B., Hugo Hirst, J. E. Kingsbury, C. P. Sparks, H. E. Harrison, Lieut.-Col. H. C. L. Holden, R.A., F.R.S., the Hon. C. A. Parsons, F.R.S., W. H. Patchell, J. H. Rider, Mark Robinson. New nominations: Sir J. Wolfe Barry, K.C.B., B. Drake, S. Dobson, R. Kaye Gray, A. A. C. Swinton.

As Associate Members of Council.—Remaining in office: W. R. Cooper, M.A., B.Sc., W. Duddell. New nomination: S. Morse.

Hon. Auditors.—For re-election: F. C. Danvers. New nomination: Sidney Sharp.

Hon. Treasurer.—For re-election: Prof. W. E. Ayrton, F.R.S. (past-President).

Hon. Solicitors.—For re-election: Messrs. Wilson, Bristows and Carpmael.

At an extraordinary meeting of the Institution held at Westminster last night, a paper on "Automatic Relay Translation for Long Submarine Cables" was read by Mr. S. G. Brown, Associate Member.

Electric Equipment of the United States Mint.—In the new Philadelphia mint the metal is electrically treated from the time it enters the building until it leaves it. Electrical current is used for refining, and the rough ignot is top and rolled, cut and weighed, all in motor-driven machines, when an acid bath leaves it ready for the coining machines, which are a unique application of a small motor driving a large fly-wheel of sufficient momentum to ensure a heavy pressure at the instant of stamping. Nearly the entire installation is of the Crocker-Wheeler manufacture, 11 new motors having been added to the already large equipment during the month of March, bringing the total number furnished up to 120, besides four generators aggregating 625 KW.—*Electrical Review* (New York).

Coronation Illuminations. — The electricity and public lighting department of the St. Pancras Borough Council has issued the following regulations for wiring, and charges for supply, for additional temporary lighting for Coronation illuminations on the nights of June 26th and 27th:—

Applications for temporary lighting for illuminations should be made as early as possible, stating the equivalent number of 8-C.P. lamps required or the amount of current. Applications will be considered in the order received, the Council reserve the right to refuse applications after a safe limit to the station, sub-station, or house lead capacity has been reached. For a special connection, the charge will be the actual cost of same, this charge to be refunded if the supply becomes permanent within three months. For the supply of current there will be a charge of 1d. per 8-C.P. lamp or its equivalent per night. Connection can only be made subject to the above, and the following wiring regulations for temporary work:—

(*a*) Current Density. The maximum current allowed by the I.E.E. rules will be approved, viz.:—

Size S.W.G.	Amperes.
18	4·2
17	4·4
16	6·8 &c.

(*b*) Insulation to earth. If tested in wet weather to be such that not more than $\frac{1}{15000}$th of the whole current required can leak, assuming one pole to be earthed. If tested in dry weather to be such that not more than $\frac{1}{20000}$th of the whole current required can leak, assuming one pole to be earthed.

(*c*) Joints need not be soldered, provided that the wires are well cleaned, that the joint is mechanically strong, that the joint is well insulated with both pure rubber and black tape. (The "Britannia" form of joint is preferable.)

(*d*) Not more than 50 8-C.P. lamps are to be connected with one circuit and each circuit is to be brought direct to the temporary switchboard and there controlled by a single-pole switch and fuse in each conductor. No other fuses are to be used.

(*e*) Temporary leads are to be secured at points not exceeding 1 yard apart, either by wood cleats or bindings to insulators.

(*f*) A temporary switchboard is to be fixed close to the supply service. The board should be of hard wood or soft wood covered with sheet asbestos and be fixed in a horizontal position on brackets like a shelf; the wires to be brought up from underneath through holes in the board to various switches, &c. It is important that there should be at least 3 ft. headway above the board.

(*g*) Sufficient lead must be provided to connect the supply service.

(*h*) If any temporary wires are connected in any other manner than provided by these rules the ordinary wiring rules will hold good.

In general, it may be pointed out that the whole decoration should be regarded from the fire point of view. The amount of inflammable material, including electric light wires should be kept as low as possible. They should be as far removed as possible from the fascia board or other wood work.

London County Council.—It was reported at a meeting of the Council on Tuesday that the Board of Trade had intimated its decision not to proceed with the application of the Southwark Borough Council for a provisional order in respect of the parishes of St. George the Martyr and St. Olave, which now form part of the Borough of Southwark.

The Highways Committee stated that in connection with the reconstruction of the Westminster—Tooting tramways, it had been found that the headway of the bridge carrying the South-Eastern and Chatham Railway over Clapham High Street was only 15 ft. 2 in., while the height required in order to allow a loaded electric car to pass under the bridge was 16 ft. It had been suggested that the requisite headway might be obtained by lowering the carriage way under the bridge by 10 in. Messrs. Griffiths & Co., the sub-contractors for the road work, were prepared to lower the carriageway for £1,712 2s., and the Council resolved to entrust them with the contract for that sum.

The Committee reminded the Council of the recent acceptance of the tender of Messrs. Maclellan for the supply of track and slot rails and accessories. Included in the contract were 155 tons of sole plates, the patent rights of which were held by Mr. L. Cooper, of Leeds. After considerable negotiation, the difficulty had been overcome by making an arrangement whereby the sole plates would be supplied direct to the Council by Mr. Cooper for £1,846 5s., whilst a further delivery of 155 tons of track rails would be added to the contract with Messrs. Maclellan. The Council decided to approve the action of the Committee in entering into an agreement on that basis.

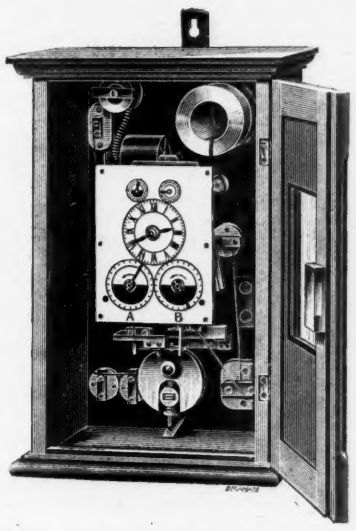
Electricity on War Ships.—In the House of Commons on 28th ult., Mr. Bowles asked whether any regulations had been promulgated by the Admiralty depriving engineer officers of the control of electrical hydraulic machinery above deck, and giving charge thereof to torpedo and gunnery lieutenants; and whether any such regulation had been withdrawn after a few weeks for further consideration; or, if not, what steps had been and were being taken by the Admiralty with reference to any such regulation. Mr. Arnold-Forster, in reply, said:—"There is no foundation for the statement that the regulation referred to has been withdrawn. When the decision of the Board to make the change was finally adopted, no orders were issued to the Fleet, because the regulations necessary to carry the new plan into effect were being specially considered by a committee appointed for that purpose. The committee have now made their report, and after it has been duly considered the necessary regulations will be drawn up. When that is done orders will be issued to the Fleet in due course."

Conference of the Electrical Industry on the Factory Act of 1901.—We are informed that the Council of the Institution of Electrical Engineers has decided to call together representatives of branches of the electrical industry which are affected by the last Factory Act, which includes in its definition of factory electrical stations.

"20. Electrical stations, that is to say, any premises or that part of any premises in which electrical energy is generated or transformed for the purpose of supply by way of trade, or for the lighting of any street, public place, or public building, or of any hotel, or of any railway, mine, or other industrial undertaking."

The meeting of the conference will be on Monday, May 12th, at 3.30 p.m. The place of meeting will be notified later on.

Wilson's Automatic Time Switch.—The apparatus which we illustrate below has been designed for the purpose of overcoming faults in the maximum demand system, and to enable supply authorities to adjust consumers' rebates in proportion solely to the number of units consumed outside the peak of the load, and not in proportion to the total number of hours over which their consumptions are spread. It is claimed that consumers are thus encouraged to burn as many lights as possible outside peak load. The advantages of the apparatus are stated as follows:—"The meter shows a direct indication of price to be charged; no complicated system of discount is necessary; the consumer can see when his high rate is being charged; it is the only means of avoiding the overlapping of the lighting and motor loads; hours of change of period can be varied with facility: values of high and low rate can be varied with facility; the instrument can be placed anywhere." The "Wilson" switch is adaptable to any existing watt-hour meter,



Wilson Automatic Time Switch (Open).

and also to any shunted meter, whether for continuous or for alternating current. It is so constructed, that by merely turning two hands on separate dials, the periods of high and low rates can be adjusted and changed at any time as required, without interrupting the current. It consists of an electrically-driven pendulum-clock, which beats normal time, and which actuates a relay. The function of this relay is to insert a resistance into the shunt circuit of the meter during the low-rate period, and also to keep this resistance short-circuited during the period of high rate. The insertion of this resistance will make the meter "slow." A most important point in connection with the instrument is the fact that the resistance which it cuts in or cuts out in series with the shunt coil of the meter, can be inserted in the meter itself, so that any time switch can be used with any meter. Should it happen that the meter or the time switch required re-adjusting, it would not be necessary to take away both instruments. The apparatus is being supplied by the General Electric Co. (1900), Ltd.

A Coronation Suggestion.—Judging from the lucid and tony report of the dinner of the Institution of Mechanical Engineers in the columns of a contemporary, the occasion seems to have been one for scenes of revelry by night, and the friends of the writer will no doubt feel highly flattered by his very complimentary allusions to their "particular poison." The "Coronation" effort of our estimable contemporary gave us furiously to think, and we came to the conclusion that his Majesty King Edward VII. might do worse than resuscitate the office of "King's Jester," and give the first refusal to our very own "Touchstone." A friend by our side informs us, however, that Dan Leno has already taken out a patent for the title. Just our luck!

The City Lighting.—The excessive charges made by the City of London Electric Lighting Company for the supply of current to the several institutions controlled by the Corporation have formed the subject of a conference at Guildhall within the past week or so. In particular the charge made for the use of meters has been raised of late in several cases. As the result it is probable that, unless a concession is speedily granted, a decision to transfer the contracts to the opposing company will be come to.—*The City Press.*

Bristol Street Lighting.—The Corporation is experimenting with the Bremer arc lamp, to which reference has frequently been made in our columns of late.

Royal Institution.—Mr. J. Mackenzie Davidson delivered a discourse last Friday on "X Rays and Localisation."

Bloemfontein.—A public meeting recently authorised the loan of £25,000 to extend the present electrical plant. The Mayor stated that the present plant was now run at its fullest capacity, and no additional connections could be made. This plant supplied 3,500 8-c.p. lamps, while with the plant they proposed to put down a total of 18,000 8-c.p. lamps would be available.

Personal.—Mr. Reginald J. Wallis-Jones, M.I.E.E., Assoc.M.Inst.C.E., sailed on Saturday last for New York on a short business visit to the United States in connection with electric welding and other matters.

Prof. George Forbes, F.R.S., recently left Cape Town for England.

Mr. T. Hardaker, director of telegraphs in the Transvaal Colony, lately left Cape Town *en route* for England.

Mr. Robinson, electrical engineer, Merthyr, has been appointed resident engineer at Barnsley for the tramways of the British Electric Traction Company.

Mr. Edward Dodd, A.M.I.C.E., civil engineer, announces that his brother, Mr. Robert Parker Dodd, has joined him in partnership. In future the firm will be known as Messrs. Dodd & Dodd, civil engineers, 37, Waterloo Street, Birmingham.

Admiral Sir Henry Nicholson, K.C.B., chairman, and the directors of Electric Lighting Boards, Limited, entertained a large party at luncheon at the Criterion Restaurant on 25th ult. to meet Miss A. Ashton Bence on her departure for the Cape on the company's behalf. Miss Bence, who was the recipient of many flattering telegrams, was congratulated on her enterprise by Sir Henry Nicholson, and wished "good speed" by Sir James Szlumper on her arduous task at the Cape, which has much similarity to that of her successful visit to the United States in 1901, when the company's properties in America were sold for a very large consideration.

The *St. James's Gazette* announces that Major Walter Alfred John O'Meara, R.E, C.M.G., has been appointed assistant engineer-in-chief to the Post Office. Major O'Meara is 39 years of age, and is the possessor of a somewhat exceptional military record. He entered the Royal Engineers in 1883, and the following year was awarded the "Fowke" medal of the School of Military Engineering He distinguished himself in the Burmese War in 1885—86. For some few years Major O'Meara (then lieutenant) was employed on the construction of the London—Paris telephone trunk line, and on its completion received the thanks of the then Postmaster-General. In 1899 he went to South Africa and was in Kimberley throughout the siege as chief staff officer, and was engaged in many of the fights in the early days of the war. He was Chief Intelligence Officer at Bloemfontein, and officer commanding Orange River Colony Provisional Mounted Police, March 13th to June 7th, 1900. He was afterwards assistant to the Military Governor, Johannesburg, as acting Major until May of last year.

Mr. E. Macgregor Duncan has resigned his position upon the staff of Messrs. Kennedy & Jenkin, in order to commence practice as a consulting engineer. His office address is 27, Old Queen Street, Westminster.

Institution of Civil Engineers.—The Council have made the following awards for papers read and discussed before the Institution during the past session:—A Telford Medal (in standard gold) to Mr. W. M. Mordey, and a George Stevenson Medal (in standard gold) to Mr. B. M. Jenkin, M.Inst.C.E.; a Watt Medal (in standard gold) to Mr. J. A. F. Aspinall, M.Inst.C.E.; and Telford Premiums to Messrs. W. C. Copperthwaite, A. H. Haigh, B.Sc., and J. Davis, M.Inst.C.E. The Council have also awarded the Howard Quinquennial Prize of the Institution to Mr. R. A. Hadfield, M.Inst.C.E, of Sheffield, for his scientific work in investigating methods of treatment and new alloys of steel, and on account of the importance in industry of some of the new products introduced by him. The presentation of these awards, together with those for papers which have not been subject to discussion, and will be announced later, will take place at the inaugural meeting of next session.

The Municipal Electricals' Convention.—The following is a list of the preliminary arrangements for the London Convention, July 2nd, 3rd, 4th and 5th, of the Incorporated Municipal Electrical Association:—

Wednesday, July 2nd, Presidental Address, by J. H. Rider; "Double Current Generators and their Application," by E. T. Ruthven Murray; "H.T. Continuous Current Systems," by A. S. Barnard.

Thursday, July 3rd, "Steam Turbines," by S. E. Fedden; "The Correct Type of Engine for large Generating Stations," by A. A. Day.

Friday, July 4th, "Some Notes *re* Earthing," by H. Faraday Proctor; "Two *v.* Three-Wire Distribution," by J. F. C. Snell.

Arrangements are in hand for visits to be made to various works and other places of interest. It has been arranged to hold either the usual Annual Dinner or to substitute a Smoking Concert, as the majority of the members may decide. It has been thought that a Smoking Concert would afford a better opportunity for members to meet one another, and especially for enabling the newer members, whether Councillors or Engineers, to become known to each other. Further details and full programme will be issued in due course, and to facilitate these the cards have to be filled in and returned not later than May 5th.

Lectures.—On Friday night, Sir William H. Preece, K.C.B., F.R.S., who is this year president of the Wolverhampton Literary and Scientific Society, delivered his presidential address to the members in the Agricultural Hall, his subject being "Communication to Great Distances by Means of Electricity."

Two special courses of lectures on "Wireless Telegraphy," and "Electric Traction" respectively, are to be delivered at the East London Technical College, by Mr. J. T. Morris, commencing on Monday next week. See our "Official Notices" to-day for particulars.

Cardiff Tramways.—Yesterday, Thursday, the opening ceremony of the Corporation tramways took place at Cardiff.

Municipal Trading.—In the House of Commons on 28th ult., Mr. Kimber asked the First Lord of the Treasury whether he could state when he proposed to nominate the Committee on Municipal Trading, and in reply, Mr. Balfour said that he would be glad to see the Committee appointed as soon as possible, but the present condition of public business made it impossible to find time for a debated motion on the subject.

Royal Society.—Among the papers down for reading yesterday were the following:—"The Conditions Determinative of Chemical Change and of Electrical Conduction in Gases, and of the Phenomena of Luminosity," by Prof. H. E. Armstrong, F.R.S. "Contributions to a Theory of the Capillary Electrometer."—I. The Insulation-Resistance of the Capillary Electrometer, and the Minimum Quantity of Electricity required to produce a Visible Excursion, by G. J. Burch, F.R.S.

Appointments Vacant.—Two pupils for the Southwark electricity works; foreman and deputy-foremen for the Manchester Corporation car depôt; a professor of physics and electrical engineering is required for the Victoria Jubilee Technical Institute at 500 rupees per month (rising to 800 rupees) on a five years' engagement. See our "Official Notices" to-day.

Patent Amendment Application.—Mr. H. Crichton is applying for leave to amend Patent No. 580, of 1896 (H. H. Farrell), for "Improvements in and connected with seats."

South Wales Electrical Power Scheme.—The ceremony of laying the foundation stone of the Pontypridd power station was performed on Wednesday by Sir Frederick Bramwell, in the presence of a large and distinguished company. We shall refer to this important function in detail next week.

THE CENTRAL STATION ENGINEER.

The Tynemouth Town Council has increased the salary of Mr. Turnbull, the electrical engineer, to £300 per annum.

The Leith Corporation E. L. Committee has appointed Mr. A. P. Rutherford, burgh electrical engineer, in succession to Mr. J. Gray Scott, who received an appointment at Croydon. M. Rutherford has been employed as an assistant at the electric lighting station since the undertaking was commenced.

The Stoke Council has appointed Mr. P. J. S. Tiddeman, of St. Annes-on-the-Sea, electrical engineer, at a salary of £250 a year. Mr. Tiddeman went to St. Annes from Pontypool, Wales, about two years ago.

Mr. F. C. Pay, the newly-appointed engineer and manager at the Newton Abbot electricity works, was, before leaving Hammersmith, presented with an oak case of drawing instruments from the staff and employés under him.

On Thursday, April 24th, a dinner was held at the Savoy Hotel, Newcastle, by the junior engineers of the Newcastle Electric Supply Company, after which an interesting programme was very successfully carried out.

Mr. J. W. Donnet, the superintendent of Pinkston Power Station, having been appointed resident engineer to the Trafford Power and Light Supply Syndicate, Trafford Park, Manchester, Mr. James L. Graham has been appointed to the vacant position at Glasgow.

On Tuesday last week an interesting ceremony took place at the Maidstone Corporation Electricity Works, when Mr. E. E. Hoadley, the borough electrical engineer, was presented with a marble chiming clock on the occasion of his approaching marriage. Mr. Carr, the chief assistant, in making the presentation, spoke of the good feeling which existed between the staff and the chief.

A smoking concert in aid of the funds of the Brighton Electricity Works Club was held at the Unicorn Hotel, North Street, on Monday evening. Mr. G. Goodall presided, in the unavoidable absence of Mr. Christie. A capital musical programme was gone through.

NEW COMPANIES REGISTERED.

Provincial Electric Construction Company, Limited (73,442).—This company was registered on April 15th, with a capital of £3,000 in £1 shares, to acquire the business of a general electrician and contractor, carried on by G. F. Rimmer, at 19, Minster Buildings, Church Street, Liverpool, and to carry on the business of producers and suppliers of electric light, heat and power, constructors of cables, lines, wires, accumulators, and works, electricians, mechanical and electrical engineers, metal founders and workers, smiths, hardwaremen, manufacturers of rolling stock, &c. The first subscribers (each with one share) are:—E. Wiese, Holly Mount, 71, Rowson Street, New Brighton, merchant; T. Salveton, 12, Jermyn Street, Liverpool, shipbroker; C. L. G. Weise, Holly Mount, 71, Rowson Street, New Brighton, clerk; Mrs. A. J. Rimmer, Holly Mount, 71, Rowson Street, New Brighton; Mrs. M. E. L. Rimmer, 30, Empress Road, Liscard; G. F. Rimmer, 30, Empress Road, Liscard, electrical engineer; and A. C. Montgomery, 27, Denton Drive, Egremont, Cheshire. No initial public issue. George F. Rimmer is the first sole managing director; qualification of ordinary directors, £50; remuneration as fixed by the company.

Cooper Patent "Anchor" Rail Joint Company, Limited (73,421).—This company was registered on April 14th, with a capital of £6,007 in £1 shares, to carry on the business of makers of rails, rail joints and parts of rails and joints for railways, tramways and the like, and materials for securing rails and rail joints and parts thereof to underbeds of railways, tramways and the like, ironfounders, mechanical and electrical engineers, manufacturers of tools, implements and machinery, manufacturers of rolling stock, hardwaremen, &c., and to take over the business now carried on by L. Cooper, L. Cooper, jun., G. H. Archer and W. Howard-Smith at Central Bank Chambers, Leeds. The first subscribers (each with one share) are:—L. Cooper, Central Bank Chambers, Leeds, iron merchant; L. Cooper, jun., Corn Exchange Buildings, Manchester, iron merchant; Mrs. A. H. Cooper, Swanwick House, Prestbury; W. Howard-Smith, 20, Victoria Street, S.W., civil engineer; E. M. Griffiths, 1—3, Ludgate Circus, E.C., machinery merchant; L. A. Orford, 87, Fountain Street, Manchester, solicitor; and G. H. Archer, Central Bank Chambers, Leeds, iron merchant. No initial public issue. The number of directors is not to be less than two nor more than five; the first are Leonard Cooper, Leonard Cooper, jun., and George H. Archer; qualification, 300 ordinary shares; remuneration as fixed by the company. Registered office, Central Bank Chambers, Leeds.

Electric Carriage and Storage Company, Limited (73,476).—This company was registered on April 18th, with a capital of £100 in £1 shares, to carry on the business of an electric carriage and storage company in all its branches, to construct and deal in carriages, motor cars, vehicles, electric appliances, machines, lines, cables, and works, and to produce and supply electricity for all purposes. The first subscribers (each with one share) are:—A. P. Clyne, 3, Norfolk Mansions, East Putney, S.W., estate agent; H. Hickson, 19, Balaclava Road, S.E., clerk; W. H. Parker, 90, Fordwych Road, Brondesbury, secretary; J. R. Davies, 24, Delamere Street, W., clerk; F. Davies, 95, Finsbury Pavement, E.C., chartered accountant; W. B. Anderson, 169, Breakspears Road, Brockley, S.E., clerk; and V. Malpage, 70, Hillfield Road, West Hampstead, N.W., clerk. No initial public issue. Registered without articles of association. Registered office, 65, New Broad Street, E.C.

Rosario Electric Company, Limited (73,541).—This company was registered on April 24th, with a capital of £120,000 in £5 shares, (12,000 preference), to adopt an agreement with the City Safe Deposit and Agency Company, Limited, and to carry on in the Argentine Republic or elsewhere in South America the business of generators, producers, storers, and distributors of and dealers in and with electricity and electric force, users of the same for lighting or heating, or as a motive agent or otherwise, electric lighting contractors, railway and tramway contractors, promoters, financiers, engineers, electricians, &c. The first subscribers (each with one preference share) are:—A. J. Swan, 31, Choumet Road, Peckham Rye, S.E., clerk; S. H. Penwarden, 13 Comeley Bank Road, Walthamstow, clerk; A. D. Brown, 31, Brighton Road, Upper Clapton, N.E., shorthand writer; G. E. Sanders, 51, Larkfield Road, Richmond, clerk; J. W. Pollard, 120, Olinda Road, Stamford Hill, N., clerk; H. J. Robinson, 88, Dean Street, Oxford Street, W., clerk; H. Dixon, jun, 6, Vale Road, Finsbury Park, N., clerk. Minimum cash subscription, 40 per cent. of the shares first offered to the public. The number of directors is not to be less than three nor more than six; the subscribers are to appoint the first; qualification, £250; remuneration, £600 per annum and a share in the surplus profits after 8 per cent. dividend is paid (such share not to exceed £600 in any year) divisible.

London Electrical Syndicate, Limited (73,540).—This company was registered on April 24th, with a capital of £2,000 in £1 shares, to acquire any inventions relating to improvements in galvanic cells or otherwise, and in particular to acquire from G. B. Pushmüller, the benefit of certain existing inventions, and to carry on the business of electricians, mechanical engineers, suppliers of electricity, &c. The first subscribers (each with one share) are:—A. J. McMillan, 3, Frederica Road, Chingford, secretary; G. B. Pushmüller, 19, Mornington Crescent, N.W., inventor; F. Bernstein, 24, Hampton Road, Ilford, merchant; Mrs. J. Pearson, Pitfour, Ilford; G. R. Pearson, Pitfour, Ilford, clerk; H. R. Pearson, Pitfour, Ilford, clerk; L. R. Pearson, Pitfour, Ilford, clerk. No initial public issue. The number of directors is not to be less than two, nor more than seven. The first are G. Pearson and G. B. Pushmüller; qualification, one share; remuneration as fixed by the company.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Smithfield Markets Electric Supply Company, Limited (53,354).—This company's annual return was filed on March 4th, when 12,000 shares were taken up out of a nominal capital of £100,000 in 20,000 shares of £5 each; £5 has been called up on each share, resulting in the receipt of £60,000. Mortgages and charges, £58,000.

Westminster Engineering Company, Limited (50,677).—Particulars of registered mortgages and charges:—

Amounts secured.	Date of resolutions creating series of debentures.	Dates and amounts of debenture issues when more than one issue is made in same series.	Property charged.	Trustees.	Total amount previously issued of same series.
£4,000 in 40 second debentures of £100 each.	August 29th, 1900.	April 22nd, 1901. £200	All the property of the company, present and future including uncalled capital.	None.	£2,800.
£6,000 in 60 debentures of £100 each.	February 4th, 1902.	—	The undertaking and property of the company, present and future, including uncalled capital.	None.	—

Eastern Telegraph Company, Limited (5,338 C).—Particulars of registered mortgages and charges:—

Amount secured.	Dates of resolutions creating debenture stock.	Amounts issued.	Dates of issues.	Property charged.	Persons entitled to the charge.	Amount previously issued.
£50,000 debenture stock	March 27th, 1901.	£47,619	Apr. 17th, 1901.	A first charge on the undertaking and property of the company.	Certificate issued to Telegraph Construction & Maintenance Co., Ld.	£1,482,368
£10,000	July 17th, 1901.	£10,000	July 17th, 1901.	Ditto.	W. H. Burman.	
£44,758	Jan. 15th, 1902.	£44,758	Jan. 15th, 1902.	Ditto.	Prudential Assurance Co., Ld., & Telegraph Construction and Maintenance Co., Ld.	

THE KARLSRUHE ELECTRICITY WORKS.

The municipality of Karlsruhe, in Baden (Germany), has recently opened a new generating station, and has adopted the three-phase high-pressure system for the distribution of electricity for light and power throughout the town and harbour. The station is distant about three miles from the town, and is close to the new Rhine Harbour, for which the bulk of the current is required. The electrical equipment,

Fig. 1.—Mosbach Continuous Current Station.

with which we are chiefly concerned, was entrusted to the Electrical Industries, Limited, Karlsruhe, represented in this country by Messrs. H. V. Kramer & Co., Bath.

The ground plan and sectional elevation of the station are shown in fig. 4. Fig. 2 gives a general view of the engine room.

The generating plant consists of three steam alternators, space being allowed for a fourth—each of 560-kw. capacity, at 4,000 volts per phase, and 50 cycles per second. Six boilers are provided, each having 2,600 sq. ft. heating surface, of which 600 sq. ft. are superheater surface. The boiler pressure is 140 lbs. per sq. in., and the steam is superheated to 480° F. Two electric pumps lift the feed water from a sunk well to the filters, from which it flows to two tanks, each of 11,000 gallons capacity. Steam feed pumps supply the feed water to the boilers through feed-water heaters.

The engines are of the horizontal tandem compound type, supplied by Messrs. G. Kuhn, of Stuttgart, and each is rated for an output of 600 h.p. normal, and 760 maximum at 91 revolutions per minute.

The three-phase generators are of the fly-wheel type, direct coupled to the engine, and separately excited from overhung dynamos. The magnet wheel weighs 34 tons, and carries 66 poles, wound with rectangular copper tape. The variation in angular velocity is not greater than 0·3 per cent., and the generators consequently run well in parallel. The exciter is wound for about 70

Fig. 3.—Karlsruhe Transformer Tower

volts, and its armature can easily be drawn off the main shaft.

The construction of the generators is specially designed to give free access to all parts of the winding, and the lower half

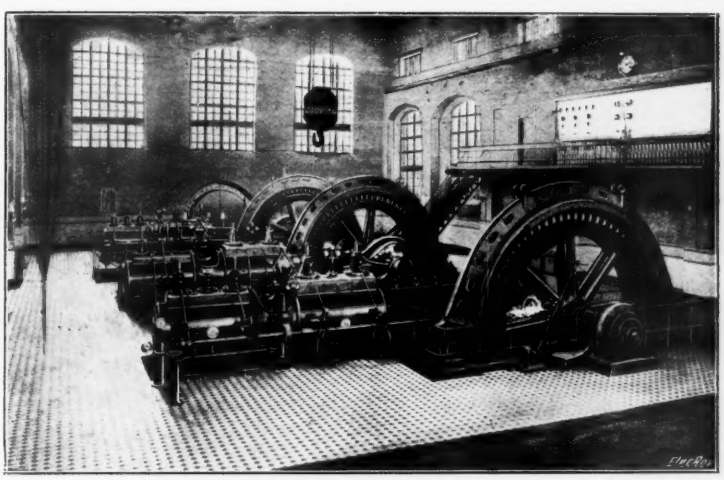


Fig. 2.—Karlsruhe Engine Room.

of the armature winding can be easily inspected from the alternator pit. If necessary, the whole frame, after being

fixed to the magnet wheel, can be rotated so that the lower half is open to inspection from the engine room floor.

The cables from the alternators are led into a chamber reserved exclusively for all the high pressure apparatus,

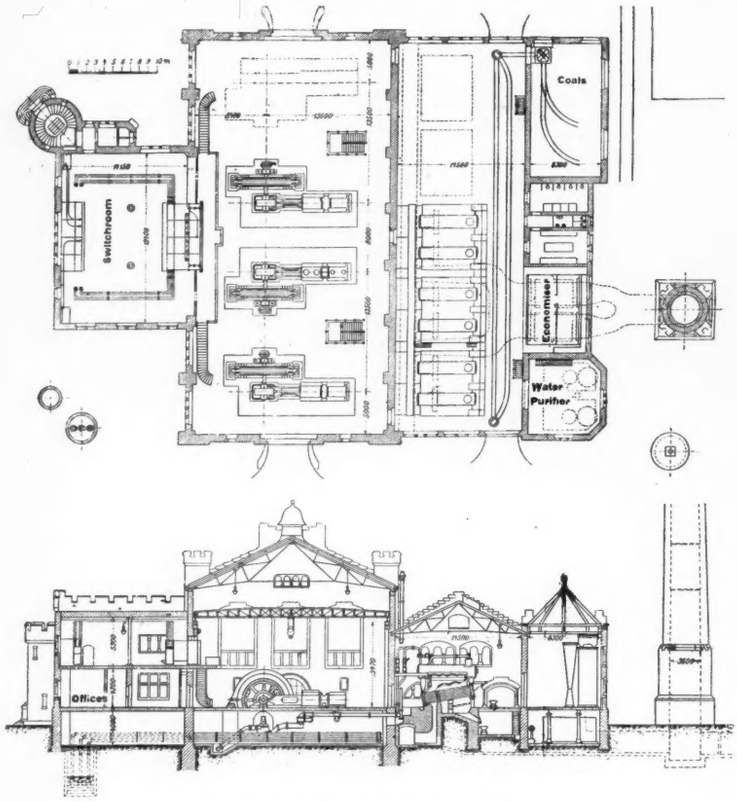


Fig. 4.—Karlsruhe Electricity Works.

where plenty of space is allowed for the fixing of "live" parts at a safe distance from each other and from the framework. Special attention is given to the high pressure fuses, and each is separately enclosed on three sides in a glass and porcelain case to prevent the damaging effects of an arc. The cases are open only to the front, to allow for replacement. The general appearance of the switchboard in this room can be seen from fig. 5.

The generating plant is controlled from the main switchboard in the engine room, on which no apparatus has a higher voltage than 120, this being also the pressure of supply. The transformers for the ammeters and voltmeters are placed in the high pressure chamber. No measuring instruments are provided for the exciters; their regulators are fixed on the generator panels. To facilitate the paralleling of the alternators, the governors of the engines can be separately regulated by means of small electric motors, operated from the generator panels; also, by means of a mechanical coupling, all the governors can be regulated together from the centre panel. Under running conditions, therefore, the attendant has only to watch the centre panel—the voltmeter which shows the pressure at the distributing points being fixed on this panel—and need only give attention to the generator panels when starting or stopping one of the machines.

The feeders are taken from the bus bars in the high pressure room, each feeder having a separate panel equipped with the necessary instruments. The feeder network consists of two complete ring systems, one for lighting and one for power, each ring feeding two distributing points. Two of these points are in the town, and two on the harbour (Rhine), and from these points branch off the high pressure distributing cables to the transformer stations; 40 miles of cables in all have been laid down.

Coming now to the transformer plant, five of the transformers are underground; 44 are in towers above ground, 36 throughout the town, and eight on the harbour, and 10 are in private houses. In all, 70 transformers are in use, varying in output from 15 to 50 kw.

Fig. 3 shows one of the transformer towers, which are in general use. In the interior three switchboards are arranged in the form of a triangle, and the tower itself can be revolved, so as to give access to all the gear, one door only being necessary. This door opens opposite the low-pressure board, and the tower can then be turned into the second position for the high pressure gear, and to the third, which allows for easy inspection or replacement of the transformer. The great advantages obtained by this simple arrangement are at once apparent, as regards both safety and convenience. The disposition of the plant in the other transformer stations is on the same lines.

A system of connecting boxes is in use where the low-pressure distributing cables cross each other, so that if a breakdown occurs in one of the cables, its effect is greatly reduced by disconnecting this cable, and connecting to the other.

The plant has been carried out on high-class lines throughout, and has been working satisfactorily since its opening. It is a good example of a modern electric lighting and power station.

Fig. 1 is taken from a photograph of a small continuous-current station, also fitted up by the Electrical Industries, Limited. It supplies the town of Mosbach, and a distinctive feature is the method of distributing the current. The small cables or feeders consist almost entirely of aerial wires, carried on poles over the tops of the houses. The figure shows the distributing tower and the aerial wires. The two-

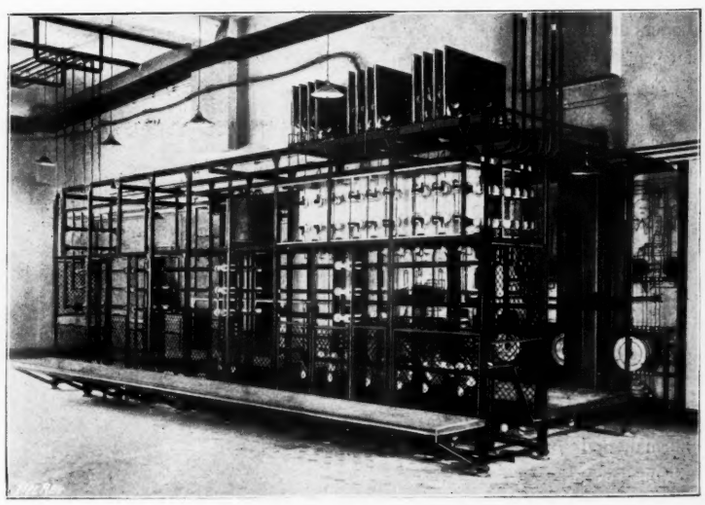


Fig. 5.—Karlsruhe Switchboard.

wire system, at 220 volts, has been adopted, in order to simplify the network, and to keep the cost of the generating plant and attendance low.

The electrical plant consists of one 90-kw. dynamo,

direct coupled to a horizontal engine, an accumulator battery of 130 cells of 600 ampere-hours capacity, and a booster set of 18 KW. Fifteen arcs and 100 incandescent lamps are provided for the main street lighting, the arcs working five in series, and controlled from the municipal buildings. Incandescent lamps are also arranged in conjunction with the arcs, so as to take their place, and are automatically switched in circuit by a cut-out, should one of the arcs fail from any cause.

BERLIN RAILWAY: VIADUCT ON THE HALLESCHEN UFER.

THE BERLIN OVERHEAD AND UNDERGROUND ELECTRIC RAILWAY.

(Concluded from page 651.)

IN addition to the long stretch of viaduct, quite a number of large bridges had to be constructed in connection with the line. One notable bridge is the Möckern, which not only crosses the Landwehr Canal, but the roads on each side, and the Anhalt railways, each of which is at a different level. To convey the line over the goods-yard of the Potsdam station, two bridges of a length of respectively 275 ft. and 465 ft. had to be built, these large spans being necessary owing to the fact that no supporting columns could be erected because of the numerous railway lines below.

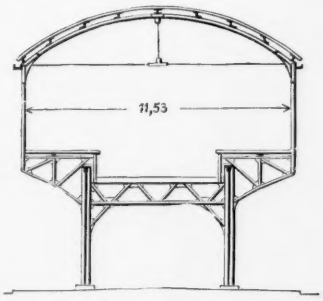


FIG. 8.—CROSS-SECTION OF OVERHEAD STATION.

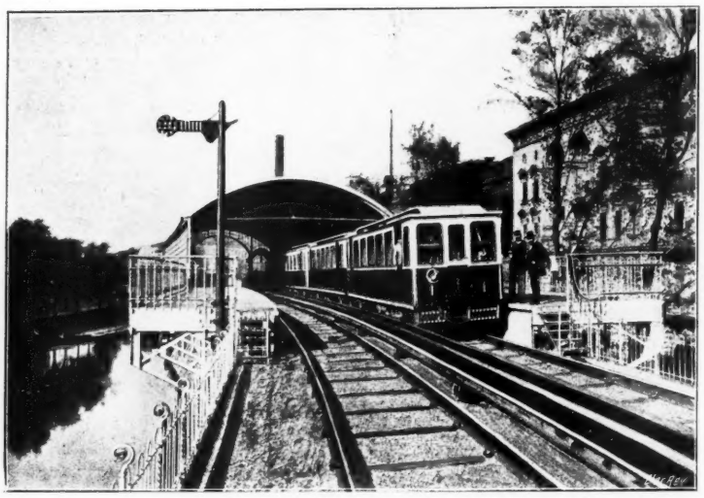
With the exception of the Eastern terminus, the two tracks are the same distance from each other in the stations as on the open viaducts, one side platform being provided for each track. Island platforms, as employed on the Berlin metropolitan railway, were not adopted for many reasons, chief among these being that the separation of the two tracks would have taken up too much space in the public thoroughfares. The platforms are on the average 262 ft. long, of which about 147 ft.—the train length—is covered. A section through one of the overhead stations is given in fig. 8. Entrance to most of the stations is afforded by a central staircase leading to a booking and waiting hall, whence side staircases lead up to each platform. At certain of the stations, however, deviations from this arrangement were necessary.

For the operation of the railway direct current is employed, and is transmitted to the working and feeder conductors between the two tracks at 750 volts pressure. The ordinary rails are made use of as the return conductor, the rails being connected with one another, as also their joints, by means of copper bonds. The working conductors, which take the form of rails, are located at a distance 3·59 ft. from the centre of the tracks and, on the overhead portion, are located to the left of the direction of the running of the train. In the tunnels, however, they are on the right hand. The working conductor rails, on which the current-collecting shoes of the railway carriages slide, are on the overhead portion, located 7 in. higher than the top of the ordinary rails, while in the underground portion they are 9 in., this increase being made to bring about the automatic switching on and off of the electric lamps in the carriages as the trains enter and emerge from the tunnels.

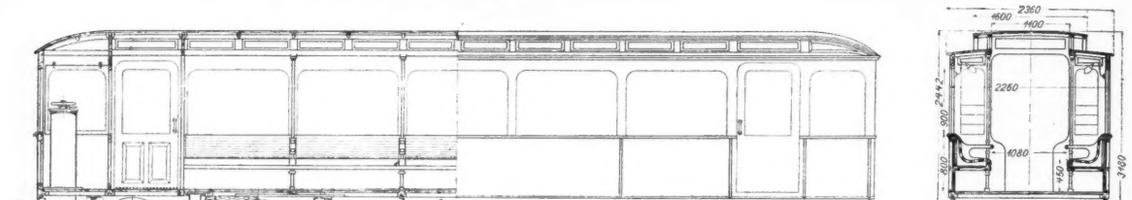
The working conductor rails have a section of 3,600 sq. mm., and are 12 metres (39·36 ft.) long. Their ends are held together by fishplates and are connected by copper bonds. They are supported on hard-rubber insulators, which in turn rest in some parts on the sleepers and in others on brackets attached to the central girder. To enable the working conductor rails on the overhead part of the line to be safely crossed, planks resting on cast-iron legs are placed at intervals of about 20 ft. In the tunnels this protection is not necessary, the conductor rails being at the side, with plenty of room between the two tracks for the railway employés to walk along. At the branches and crossings the feed and working conductors have to be broken, the current being conveyed under the crossings by cables. In the car sheds the working conductor is fixed at

BERLIN RAILWAY: VIEW IN THE TUNNEL.

a height of about 13 ft. over the level of the track. Feeder cables are laid parallel with the working conductor along



Electric Train in the Mockernbrucke Station.

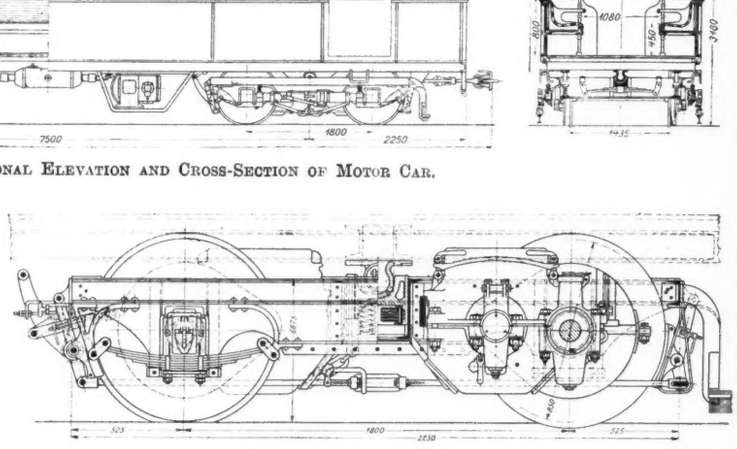


Part Sectional Elevation and Cross-Section of Motor Car.

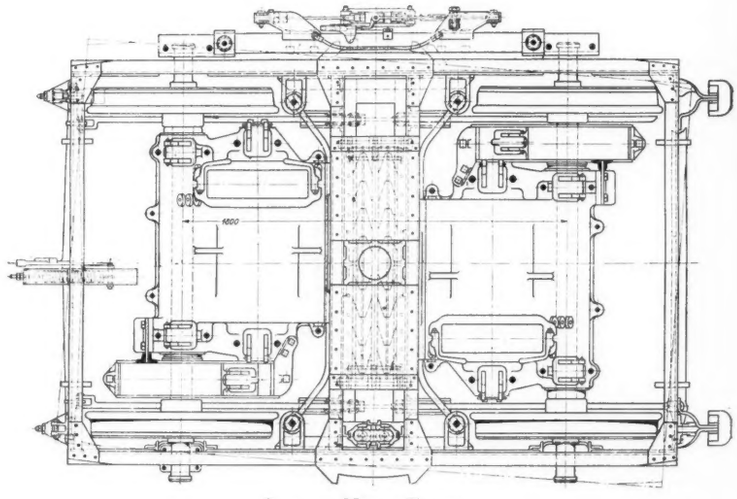
parts of the line, one extending from the power station eastwards to the Kottbuser Thor station, and another westwards to the Nollendorf Platz station.

For the lighting of the stations, car sheds, workshops, &c., a separate copper wire conductor is laid along the track at the side of the feeder cable. While the current for lighting purposes is thus not normally taken from the working conductor, yet in case of failure of the lighting main, provision is made that it can be, and this without much delay. The section of the lighting conductor ranges from 120 down to 10 sq. mm., and is such, that at the farthest point from the power station, the pressure is never less than 660 volts. At the stations near the power plant, resistances are provided to reduce the voltage to 660. In order to provide for any fluctuation in the voltage, owing to the switching off of the lamps at one station, while those at others are still in use, an equalising arrangement has been installed at the power station, and in connection with this two measuring conductors of $1\frac{1}{2}$ sq. mm. section run to the eastern terminus, and to the Wittenbergplatz station on the western section, in connection with the lighting conductors.

As the line is frequently crossed by the State telephone wires, provision has been made, so that should any of these break and fall, they cannot come in contact with the working conductor.



Elevation of Motor Truck.

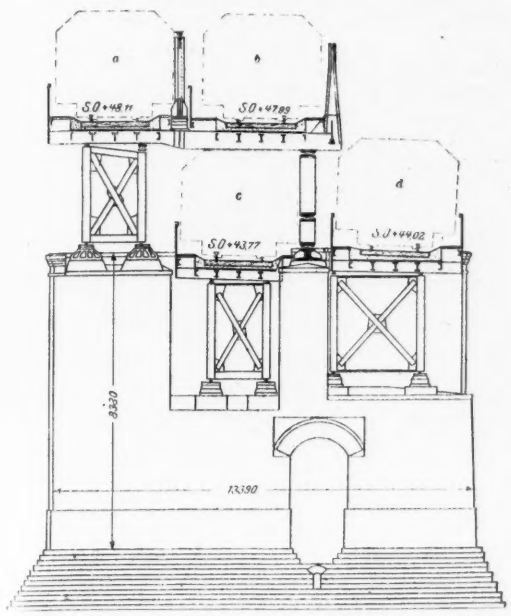


Plan of Motor Truck.

The power station is located in the Trebbin Strasse, near the triangular junction. As will be seen from the illustration on page 734 the building, owing to the heavy ground rents in Berlin, consists of three storeys. The basement, in addition to the foundations for the engines and dynamos, contains the condensers and the feed and air pumps. On the ground floor are the steam engines and dynamos and the switchboards. The boiler flues and ash receptacles are located on the next storey, while the boilers are situated in the uppermost storey, a coal bunker, over both lines of boilers, being constructed under the roof. The dimensions of the boiler house fixed the width of the power station building; as the whole width was not required for the engines, the ground floor has been divided off by pillars, and a small intermediate floor—the width of the smaller portion—built in between, provision thus being made for a repair shop, offices, &c. Two overhead travelling cranes are available in the engine room; both are electrically-operated, one having a lifting capacity of 15 tons, and the other 20 tons. The smoke stack is $11\frac{1}{2}$ ft. diameter at the top, and is 262 ft. high. The boilers are about 50 ft. above the ground, so that the chimney has a useful height of only

212 ft., the lower 50 ft. being divided into rooms which are used as stores, lavatories, cloak rooms, &c.

The boilers, which were constructed by the Rather Rohrenkesselfabrik (Gehre), of Rath, near Dusseldorf, are of

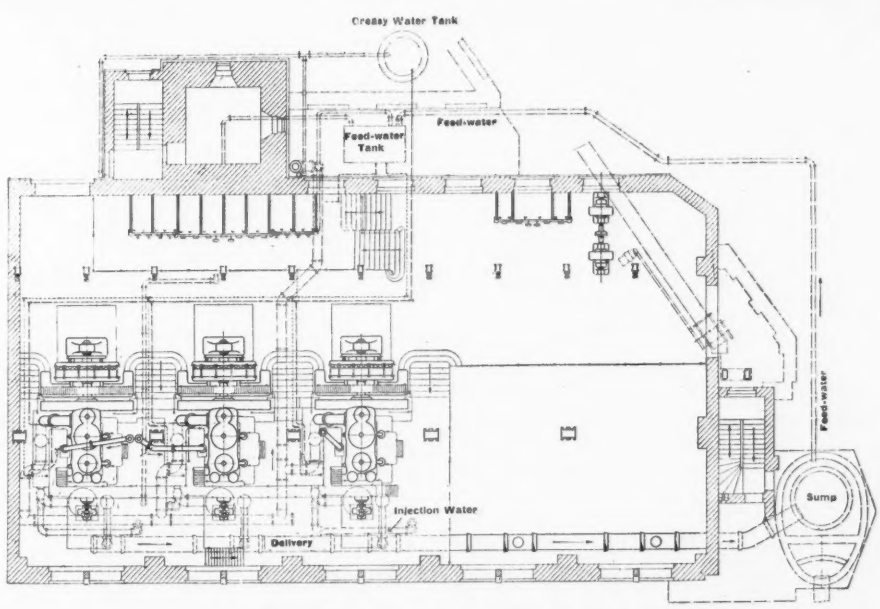


Berlin Railway: Viaduct and Masonry Work (p. 651).

the water-tube type, which, while occupying a relatively small space, have a large heating surface. They are six in number, each having a heating surface of 230 sq. metres, and working at a pressure of from 150 to 165 lbs. per sq. in. They are equipped with superheaters by means of which a steam temperature of 225° C. is attained. For the feeding of the boilers two steam pumps are provided, each having a capacity of 40 cubic metres per hour. These pumps are located in the basement of the power station and draw the necessary water either from the Landwehr Canal or from a wrought-iron tank, filled by the waste water from the air and feed pumps, and the condensation water from the steam pipes. In order to be ready for any emergency, the steam pipes from the boilers to the pumps, and the feed pipes from the latter to the boilers, have been fitted up in duplicate. From the bunkers the coal is transported to the boiler room by means of a mechanical arrangement.

In the engine room—a plan of which is given below—are three vertical compound engines built by Herr A. Börsig, of Berlin. They have cylinders 32 in. and 50 in. diameter respectively by 29½ in. stroke. The normal and maximum capacity of each engine is respectively 900 and 1,200 H.P., running at a speed of 115 revolutions per minute, and with steam at an initial pressure of 135 lbs. per sq. in. Each engine is provided with a starting device driven by suitable mechanism by means of a 20-H.P. electric motor. They are each directly coupled up to a Siemens and Halske shunt-wound dynamo, which, at a terminal pressure of 750 volts, has a capacity of 800 KW. All parts of the dynamos which need attention are located above the floor, so that they can be readily inspected. From the dynamos the current is conveyed to the switchboards by means of lead cables, protected by iron bands, and thence transmitted to the feeder cables. The main switchboard, in addition to the switches which connect the different dynamos and feeder cables with the distributing bars behind, is fitted with the amperage and voltage-measuring instruments. In connection with the feeder cables, automatic excess-current cut-outs are arranged, so that they are at once cut out should an excess of current pass, or should a short circuit occur on any part of the line. All the conductors are protected against continuous overload by means of safety fuses, located either behind the switchboard or in the basement below. A separate small switchboard—connected with the main one by cables—is provided for the control of the supplementary dynamo furnishing the current for the "buffer" and lighting batteries of accumulators. The "buffer" battery has been installed with the view of meeting any unusual power-requirement variations; it also permits any one set of the engines and dynamos to be stopped, when necessary, for a period of about an hour. This battery, together with a small 20-volt one for lighting purposes, is installed under three of the arches of the viaduct near the power station.

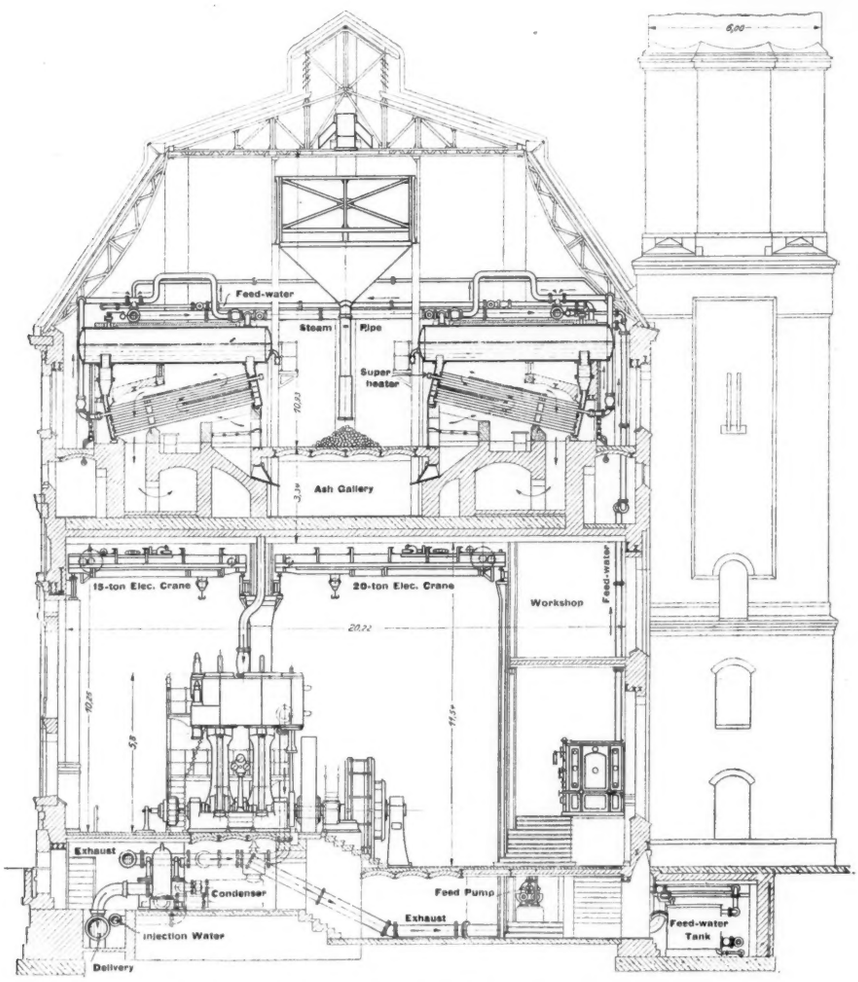
By means of the triangular junction, three services are maintained, viz., (1) Warsaw Bridge—Zoological Gardens; (2) Warsaw Bridge—Potsdamer Platz, and (3) Potsdamer Platz—Zoological Gardens. The traffic is so arranged, that at each station there is a train—in each direction—every five minutes. Between stations a speed of about 30 kilometres (18¾ miles) is attained. To maintain this service, 20 trains, each consisting of three cars, have been provided, 13 of which are simultaneously in use, the remaining seven being kept in reserve for use when repairs to any of the others are necessary. A train consists of a car at each end—for third-class passengers only, and provided with accommodation for the drivers—with a central ordinary car for second-class passengers. The system of having a driving car at each end of the train has been adopted to save time at the ter-



Berlin Railway: Plan of Engine Room.

minal stations. The end cars have seating capacity for 39 passengers, and the central ones for 44, each vehicle having in addition standing room for about 30 persons. An elevation, partly in section, and a cross-section of the cars are shown on page 732. Four separate entering and emerging sliding doors, two on each side, are provided to each car. A wooden partition separates the drivers from the passengers, while in the ends of the cars, doors are provided to enable the train conductors, in case of emergency, to get from one end of the train to the other. Each car is lighted by means of 12 incandescent lamps, brackets with candles being provided in case of any failure of the electric lighting. The car bodies, which are 39 ft. 4 in. long, and 7 ft. 9 in. wide, rest on an underframe of [iron, both being carried on two four-wheel bogies. The wheel base of each bogey is 5 ft. 11 in., and the distance between the centre of each pair 24 ft. 7 in. The frame of the bogies is connected to the electric motor, current for which is taken from the line. The brakes can also be applied by hand, while in case of accident the cars can be braked by short-circuiting. On each bogie a current collector is mounted—one on either side—the complete train thus having six collectors. By this means, notwithstanding the branches and the alteration of the position of the working conductor in the underground portion of the line, there is always at least one current collector in contact with the working conductor.

The main car sheds, which have accommodation for 32 cars, and the repair shops, are located at the Warsaw Street terminus. A small car house is also available at the triangular junction. For the safe working of the railway, a section block system of signals has been adopted throughout the line, except at the junction where a special system of block signals has been installed. A telephone line connects each station with the superintendent's office, the power



Vertical Section of Power Station.

axles through the medium of springs, while between the underframe of the cars and that of the bogies springs are also introduced, in order to increase the smooth running of the trains, and so add to the comfort of the passengers. Each car can be provided with four motors —two to each bogie—but primarily only three have been fitted. The motors are of the continuous current four-pole type, and are enclosed in cases which are at one end spring-suspended on the bogie frame and at the other supported by collars round the axle (page 732). The capacity of the motors is sufficient to enable a train-speed of 52 kilometres (31¼ miles) per hour to be attained, this being the maximum permitted by the Bill authorising the line. The power is transmitted from the motors to the axles by spur-gearing. The cars are fitted with powerful air brakes, the brake cylinder, air tank and pumps being located under the vehicle bodies between the bogies. The air pump is driven by means of a small

station, the two car sheds and with each of the next stations on the up and down lines. Intercommunication between all the stations is, however, available by means of a telephone connecting board at the power station.

In conclusion, it may not be without interest if a little space is devoted to the cost of the line. This can only be given approximately, as the various items have not yet all been definitely worked out. The original estimate has been exceeded owing to the many changes rendered necessary even during the construction of the line. The increase is largely due to the building of the triangular junction in such a way that there are no crossings, and to the necessity of making the western section underground instead of overhead. The industrial boom in 1899 and 1900, not only sent up the cost of materials considerably, but added to the rate of wages, these increases accounting for no small proportion of the extra cost of the railway. Finally, ere the line was com-

pleted, an extension of it, and an increase in the equipment to enable a 2½-minutes' service instead of a 5-minutes' to be maintained, especially on the western section, was deemed advisable and decided upon. With this object the rolling stock is being increased from 20 to 28 trains, to accommodate which a second car shed has been constructed at the Warsaw Street terminus. At the same time the western underground section is being extended, and sidings behind the Zoological Gardens station established, while at the power station the capacity is being increased to 4,800 H.P. by the installation of a fourth engine and dynamo of 1,200 H.P. The total cost of building and equipping the line, excluding the cost of land and interest, has amounted to £1,125,000, of which roundly £925,000 was spent on the establishment of the track and stations and the remainder on the power station, rolling stock, signals, &c. Interest and the extensions decided upon bring up the cost to £1,400,000, to which has to be added about £350,000 for land and buildings, rebuilding certain private buildings, &c. Although the figures given above are only approximate, for the reason already mentioned, it may be stated that the cost of the Berlin overhead and underground electric railway will not exceed £240,000 per mile, as compared with £280,000 per mile for the Paris electric underground railway, and £600,000 per mile in the case of the Central London Electric Railway. Altogether the line, in view of the many difficulties encountered, is a notable achievement in the field of electric traction, and reflects considerable credit on its builders, Messrs. Siemens and Halske, and the many capable electrical engineers forming the staff of that large concern.

The bulk of the particulars given above were obtained from a paper published in the Journal of the German Society of Engineers, by Regierungs-baumeister Langbein. For the photographic illustrations we are indebted to the courtesy of Messrs. Siemens & Halske, the builders of the railway, while the article was written for us by Mr. C. J. Webb, a frequent and valued contributor to our columns.

SUPPLY STATION ACCOUNTS.

Taunton Corporation Electricity Accounts.

The results of last year's working of the Taunton Corporation undertaking are not quite so favourable as in 1900, but the temporary retrograde movement is not of a serious character. No doubt Mr. E. B. Thornhill feels that he is doing well to be able to show a net profit of £275, when the financial results of earlier years are considered. The position can be gauged by the analysis of the output and the general statement immediately following it:—

Year.	Units generated.	Sales private.	Public lighting.	Total sold.	Number of public lamps.
1898 ...	225,958	105,853	65,230	171,083	58 arcs. 8 50-C.P. 2 32-C.P. 45 16-C.P. 40 8-C.P.
1899 ...	271,780	133,866	81,754	215,620	67 arcs. 8 50-C.P. 8 32-C.P. 105 16-C.P. 36 8-C.P.
1900 ...	434,762	178,200	128,979	307,179	72 arcs. 8 50 C.P. 15 32-C.P. 130 16-C.P. 32 8-C.P.
1901 ...	582,672	248,867	137,040	385,907	72 arcs. 8 50-C.P. 17 32-C.P. 168 16-C.P. 32 8-C.P.

GENERAL STATEMENT.

	1900.	1901.	Inc.
Total capital expenditure ...	£47,627	**£52,586**	£4,959
Number of units sold	307,179	**385,907**	78,728
Maximum load in kilowatts ...	320	**435**	115
Gross revenue	£6,649	**£6,926**	£277
Gross expenditure...	£3,638	**£4,227**	£589
Gross profit	£3,011	**£2,699**	£312
Average price per unit sold ...	4·62d.	**4·03d.**	−·59d.

In the accounts for 1901 we have followed a slightly different course to that previously adopted, in that we have taken as "sales" only the profit on manufacturing and fittings account. This was in detail:—

By sundry installations and sales of apparatus and in incandescent lamps	£842
To cost of materials and fittings for sundry installations and apparatus and lamps sold ...	764
Profit made	£78

The costs of 1900 therefore require to be reduced by excluding the special disbursements on this account, or a sum of £539, when the revenue account would contain an item only of £151 profit.

REVENUE STATEMENT.

	1900. Gross	1900. Per unit.	1901. Gross.	1901. Per unit.	Inc.
Sale of energy	£5,914	4·62d.	**£6,484**	4·03d.	−·59d.
Meter rents	184	·14d.	**209**	·13d.	−·01d.
Sale of lamps and other apparatus, and work done	496	·39d.	**178**	·11d.	−·28d.
Sundry rents received and pupils' premiums.	55	·04d.	**55**	·04d.	·00d.
Gross revenue ...	£6,649	5·19d.	**£6,926**	4·31d.	−·88d.

Coal has slightly increased, but is still under what it was in 1899. Excluding the "other expenses" item for the reasons above stated, the costs show a total increase of ·03 per unit. Taking the revenue from sale of energy only, it is noted that the drop is large, being nearly ¾d., so that in two years the reduction amounts to no less than 1¼d. per unit.

COST OF PRODUCTION.

	1900. Gross.	1900. Per unit.	1901. Gross.	1901. Per unit.	Inc.
Coal, and unloading same ..	£1,328	1·04d.	£1,787	**1·11d.**	+·07d.
Oil, waste, water, and engine room stores.	175	·14d.	263	**·16d.**	+·02d.
Salaries and wages incurred in generation and distribution, and attending street lamps.	544	·42d.	597	**·37d.**	−·05d.
Repairs and maintenance of buildings, boilers, engines, dynamos, and renewals of street lamps.	248	·19d.	265	**·17d.**	−·02d.
Works cost ...	£2,295	1·79d.	£2,912	**1·81d.**	+·02d.
Rent, rates and taxes ..	112	·09d.	131	**·08d.**	−·01d.
Management expenses, salaries of managing engineer, secretary, clerks, &c.	588	·46d.	774	**·48d.**	+·02d.
General establishment charges, stationery and printing, law charges and insurance.	104	·08d.	118	**·08d.**	·00d.
Other expenses: Royalties or fees on free wiring, and materials for installations and lamps sold.	539	·42d.	292	**·18d.**	−·24d.
Total costs ...	£3,638	2·84d.	£4,227	**2·63d.**	−·21d.

The profit has decreased by £312 in the gross, and after setting aside an extra £119 for financial charges by £431 in the net. Of the net profit, £250 has been tranferred to reserve fund, and £25 is carried forward. Taking into account a credit balance of £50, the results of the last five years are:—

Net Profits.		Allocated.	
1897	£41	To rates... ...	£600
1898	751	To renewals and reserve fund	1,604
1899	503	Balance	75
1900	706		
1901	275		
	£2,279		£2,279

The figures below deal with the year's working only.

PROFIT STATEMENT.

	1900.	1901.
Interest on loans and overdraft	£1,319	£1,542
Sinking fund for repayments	956	882
Net profit carried to reserve fund	450	250
" " credit of general rate	256	—
" " forward	—	25
Gross profit	£3,011	£2,699

CITY NOTES.

The Oriental Telephone and Electric Company.

The eighth ordinary general meeting of the shareholders of this company was held on Wednesday at the Cannon Street Hotel, Sir Auckland Colvin, K.C.S.I., in the chair.

In proposing the adoption of the report, the Chairman said that the net profits on the present occasion showed a very considerable increase over those of the preceding year, due to a great extent to the progress made in the electrical branch which they added to their telephone business some six years ago. That progress accounted at the same time for the increased amount of the item of stores in hand and in transit, for without a large and varied quantity of immediately available material the result shown could not have been obtained. That branch of their business was now well established, and the board looked forward with confidence to a further steady development. With regard to the company's telephone exchanges, they also had contributed their usual share to the prosperity of the undertaking, the difficulty being the finding of sufficient space on the existing constructions to accommodate the ever-increasing number of subscribers. That difficulty had been complicated in many places by the introduction of electric lighting and of electric tramways, whose current had adversely affected the efficient working of their telephones. The prospect of further introductions of both electric lighting and electric tramways in places which had been so far without either, compelled the board to initiate steps to effectively meet the whole question. In the autumn of 1900 they commissioned their colleague, Mr. Grewing, jun., to proceed to the East to personally inquire into the actual condition of the different exchanges of the company, and to suggest a reliable and permanent remedy. That remedy, it appeared, could only be found in duplicating their wires and in consolidating them into cables, either overhead or underground, wherever practicable. In deliberating on this question, two further very serious questions presented themselves—viz., the cost of the suggested improvements, and the life of their present licences in India, the latter of the two being the most important. They therefore requested Mr. Grewing, being in India, to proceed to Simla to open negotiations with the Government for the extension of the term of their present licenses. Those negotiations led to a definite settlement with the Government of India, who examined their proposals in a fair and equitable spirit, and had now definitely approved them with such modifications as were considered necessary by it, and accepted by the Board. They had been materially aided in this matter by Sir Allan Arthur, a director of the Bengal Telephone Company, to whom their best thanks were due. Mr. Grewing, jun., himself, had proceeded to Egypt before the final conclusion of the negotiations in connection with the reconstructions in Cairo and Alexandria which then commenced, and which were mentioned in the report; but before leaving India he had laid the foundation of the subsequent settlement. The item "Directors' Travelling Expenses" on the debit side of the accounts was increased to the extent of some £275 in connection with this journey to India and the Straits by their colleague, who, however, did not claim any personal expenses. Considering the enormous extent of ground travelled over, the charge was inconsiderable, particularly as the journey was undertaken and carried through at the hottest time of the year, and in the hottest parts of India and the Far East. Generally speaking, their exchanges were found to be in a commendable state of efficiency, having regard to the fact that few changes had been introduced in the methods of working them since they were originally organised. However, as already stated, changes had now become imperatively necessary, both on account of the overcrowded state of the wires and the appearance of electric lighting and electric tramway companies. Given those improvements, the directors looked most hopefully into the future.

Mr. Henry Grewing seconded the motion, which, after a short discussion, was adopted.

Submarine Cables Trust.

The report for the year ended 15th ult., to be submitted at the meeting of the 6th inst., shows that the revenue for this period amounted to £24,615 and the expenses to £1,251, leaving a balance of £23,364, to which is added the sum of £44 brought forward, making an available balance of £23,408. After providing £19,725 to meet payment of the coupons, the sum of £3,612 has been transferred to the redemption fund, leaving a balance of £71 to be carried forward.

Kidderminster and District Electric Lighting and Traction Company.

The gross receipts for the year to December 31st, including the amount received from the Kidderminster and Stourport Electric Tramway Company for dividend on the shares held by the company, amount to £5,181, which, added to £708 brought forward from last account, makes £5,889. After deducting the expenses (including interest on loans), amounting to £3,550, there remains a net profit of £2,339. The directors propose that this amount should be applied as follows, viz.:—To dividend on cumulative preference shares for the year 1901, £1,500; to be placed to depreciation fund, £100; to dividend on the ordinary shares at the rate of 2 per cent. per annum, £613; to be carried forward to next account, £125. The net profits for the year in respect of the tramways amounted to £2,863, which, added to £128 brought forward from last account, makes a total sum available of £2,992. This amount has been applied as follows, viz.:—To dividend at the rate of 4 per cent. on 5,720 shares, £2,288; to depreciation and reserve fund, £500; to be carried forward to next account, £204.

Leamington and Warwick Tramways and Omnibus Company.

Mr. E. Garcke presided at the ordinary meeting of this company held last week in London, and moved the adoption of the report and accounts. He explained that the majority of the shares were held by the British Electric Traction Company, and that company was fully informed of the position of this company's affairs. The report and accounts were full and accurate, and required no explanation, and he therefore moved their adoption. This was seconded by Mr. Purser and agreed to. A dividend of 6 per cent. on the ordinary shares, carrying forward £260 to the next account, was approved of.

West Coast of America Telegraph Company.

The report for 1901, to be presented at the meeting on the 6th inst., states that the gross receipts amounted to £32,106, against £30,888 in 1900, showing an increase of £1,218. The working expenses, £23,022, compared with £23,046 for the previous year, showing a decrease of £24. After providing £6,000 for the interest on the 4 per cent. debentures and £800 for the interest on the 4 per cent. income bonds, there remains a balance of £2,284, to which is added the sum of £588 brought forward, making a total of £2,872. Of this amount £1,500 has been placed to a general reserve fund and £1,000 to a maintenance ships' reserve fund, leaving a balance of £372 to be carried forward.

Eastern Extension Telegraph Company.

The report for the half-year ended December 31st last, to be submitted at the meeting on 7th inst., shows that the gross receipts amounted to £324,209, against £360,889 for the corresponding half-year of 1900. The working expenses, including £29,447 for maintainance of cables, absorb £120,294, against £104,604 for the corresponding period of 1900, leaving a balance of £203,915. From this is deducted £7,715 for income-tax, £6,400 for interest on debenture stock, and £263 for donations to the London School of Tropical Medicine and Yangtse Flood Relief Fund, leaving as the net profit for the half-year £189,537. After adding £15,023 brought forward from the previous half-year, there is an available balance of £204,561. It is proposed to distribute the quarterly dividend of 1¾ per cent. on May 8th, making a total dividend of 5 per cent. It is also proposed to pay a bonus of 4s. per share, or 2 per cent., making a total distribution of 7 per cent. for the year 1901. The balance of £69,561 has been transferred to the general reserve fund.

Prospectuses.

This week the prospectus of Messrs. Beyer, Peacock & Co. (1902), Limited, locomotive builders and general engineers, of Gorton, Manchester, the excellence of whose work is very widely recognised and is maintaining the reputation of British made locomotives and machinery in different parts of the world, has been before the investing public with an issue of ordinary and preference capital and debentures. The nominal capital is £500,000 ⅗ths of it being 5½ per cent. preference and ⅖ths ordinary, all in £1 shares, and there is to be £300,000 debenture stock at 4¼ per cent.

The prospectus of the South Wales Electrical Power Distribution Company is now before the public, offering 42,750 £10 shares for subscription, and it will be found in our Business pages to-day. The nominal share capital is £750,000 in £10 shares, and the company has power to issue £250,000 in debentures. The objects of the undertaking have been frequently outlined in our columns. The ceremony of laying the foundation stone of the power station at Pontypridd was performed on Wednesday. The list opens on Tuesday next and closes on Friday, May 9th. The contractors for the undertaking are:—Messrs. Willans & Robinson, Limited, for the engines, boilers, and general equipment of the stations; Messrs. Ganz & Co., for the electrical machinery; Messrs. Callender's Cable and Construction Company, Limited, for the mains; Messrs. Holloway Bros., for the buildings.

West India and Panama Telegraph Company.—Dividend of 6s. per share on account of arrears of dividend on first preference shares.

Brisbane Electric Tramways Investment Company.

THE report of this company, from November 20th, 1900, to December 31st last, to be submitted at the meeting to be held on the 8th, inst., states that:—

The net amount in dividends received on the shares held by this company after deducting income-tax, was for 1901, £42,430, to this has to be added the amount attributable to revenue in respect of the period from November 20th to December 31st, 1900, £2,821, and sundry receipts £660, leaving a balance to credit of revenue account £45,912. After deducting general charges in London and expenditure in Brisbane, including insurance undertaken by this company under its contract with the Tramways Company, £3,096, there remains a net balance available of £42,815. The debenture stock interest from dates of payment of instalments has absorbed £15,916, and an interim dividend calculated from the date of allotment has been paid on the preference shares amounting to £10,000. There thus remains a sum of £16,898, and the directors recommend that this be appropriated in the following manner: To payment of a balance dividend of 2s. 6d. per share on the preference shares, making up the full dividend at the rate of 5 per cent. per annum, carrying forward £7,523. The extensions which this company undertook to construct on behalf of the Tramways Company, are now either open to traffic or approaching completion, and the power station has recently been equipped with new additional electrical plant and boilers, thus placing the company in a position to deal with considerably increased traffic.

Alliance Electrical Company.

THE following is a copy of the directors' report which came before the meeting held at the offices in Regent Street on Monday:—

The directors are pleased to report that the business of the company during the twelve months ending January 31st, 1902, has resulted in a profit, which, after deducting directors' fees and expenses of management, and making due provision for depreciation and for bad and doubtful debts, leaves, with the balance brought forward from last year, an amount available for dividends of £6,837 6s. 1d. Warrants for the interest on the preference shares have been duly posted, and the directors propose to declare a dividend of 6 per cent. on the ordinary shares, carrying forward a sum of £258 5s. 4d. In spite of the continuance of the war and general depression of trade, the company's installation departments in London, Birmingham, and Manchester have been well employed during the last twelve months, and several important electrical works have been completed. The company having been entrusted by the War Office with the carrying out of electrical works in connection with the fortifications on the Firth of Forth, the directors considered it would be a good opportunity to open a branch in Edinburgh for dealing with Scottish business. Premises were therefore secured at No. 31, Princes Street in August last, and already satisfactory results have accrued, several installations are at present in hand, and numerous estimates for further work are being sent out. An important agency has been concluded with an electric carriage manufacturing company to represent their vehicles in England, and a department has been organised at the Head Office for effectively dealing with this. The company hopes to place electric carriages on the market during the coming London season. As the majority of the illuminations in London in connection with the forthcoming Coronation festivities will be electric, special attention is being devoted by the staff to this. Already numerous contracts have been secured, at remunerative rates, and the directors anticipate a considerable revenue from this source. The directors are glad to state that the prospects of the company for the future are very encouraging. The returns of orders since the accounts have been made up are higher than all previous records, and, judging from the estimates being sent out, this satisfactory state of affairs is likely to continue.

Indo-European Telegraph Company, Limited.

MR. J. HERBERT TRITTON (Chairman) presided on Wednesday morning at the offices, 18, Old Broad Street, E.C., over the 35th ordinary general meeting of the above company; and in moving the adoption of the report, said that those who were present at the last general meeting would no doubt remember that he expressed a strong wish on behalf of the company that the reduction of the telegraphic rate to India could be brought about. Unfortunately, there were obstacles in the way at that time, and it appeared to be almost impossible to overcome them. In several quarters this company was held to be the stumbling-block, but this was by no means the case. The International Telegraphic Convention provided that every interested administration shall give its consent before an alteration in the rates can be made. This company expressed without the slightest reserve its cordial concurrence in the plan of the reduction when first mooted, and endeavoured by persistent negotiations to procure the assent of all parties, but this was not obtained until this year, when, of course, the reduction was brought into force forthwith. It was unnecessary to impress upon them the considerable decrease that might be expected in the revenue, seeing that the rate had been reduced from 4s. to 2s. 6d. per word, making a reduction of 1s. 6d. per word. The Indian Government had, however, agreed to share in the reduction to the extent of one-third of the loss that would have to be sustained. Several reductions, of minor importance, had been introduced over the company's system, and the rate for messages exchanged between this country and Australia had been further reduced to 3s. per word, the standard for this traffic having been maintained for three years. The policy of the company was to give reductions in telegraphic rates where possible, to facilitate commercial enterprise, so long as the revenue of the company was not reduced to too narrow a margin. He informed them at the last general meeting that experiments for direct working were being made with the Wheatstone apparatus between Emden, in Germany, and Teheran, the terminal station of the company's route in Persia, and was glad to say that the result of these experiments at the time was highly satisfactory, and consequently the system had now been finally introduced, and had been working for some months. The result had exceeded their expectations, inasmuch as the delay between London and Teheran had been reduced by at least a third, and this in the face of increased traffic brought about by the reductions in the rate of Australia and India. They hoped to introduce the Wheatstone apparatus between London and Emden, or, better still, London and Berlin, thus having the one system from end to end of the line, and by this means they anticipated a further reduction in the time of transit over the company's system, and a consequent greater carrying capacity of the wires. The Marconi system of wireless telegraphy had, according to what they read in the public press, rival systems to contend with, while presumably it was not itself fully matured. The future might have in store surprises for wireless systems should they be multiplied, but the speed, secrecy, and certainty of land wires and ocean cables did not appear to be threatened at present. The Inter-Departmental Committee on Cable Communications issued an interim report in August last, and had within the past few days issued their final report. The conclusions therein arrived at were generally favourable to the telegraph companies, and recognised the value of the services they had rendered to the Empire and Commerce. They did not recommend further reductions of tariffs, though they were in favour, under certain circumstances, of a system of deferred rates. Turning to the financial position of the company, the gross receipts showed a slight increase over last year, which was to be accounted for to a great extent by the satisfactory increase in the traffic with South Russia. The debit for maintenance was this year only £23,185 0s. 6d., instead of £38,827 6s. 6d. last year, and similar amounts in previous years, the reason being that there had been no need to make any appropriation for writing down the value of the lines of the company by the amount which he had repeatedly explained, had been included under the head "maintenance and charges." They would see that the word "charges" was omitted this year. The amount carried out of revenue account into profit and loss was consequently £89,181 12s. 8d., as against last year £73,284 5s. 5d. They had no doubt noticed, in the profit and loss account, that an amount of £33,992 13s. 11d. had been paid to their partners in the joint purse, on account of an alteration in the outpayment made to the German Government by this company, and an explanation of this outpayment was necessary. They must go back to the year 1877—8, when this company formed a joint purse with the Eastern Company in the Indo-European Telegraph Department; the outpayment to Germany was notified to their partners as being 2·50 fr. for every 20 words. However, the German Government did not favour this form of payment, because if, after the establishment of the joint purse, the bulk of the traffic passed over the Eastern Company's cables, the amount under this 20-word payment that would be paid to her would be considerably reduced, and it was therefore arranged that Germany should receive a percentage of the receipts of the company from the joint purse, and their accountant at that time worked out this percentage so that the amount paid to the German Government should be the same as she would have received under the word payment. The German Government, in accepting this arrangement, reserved to itself the right to revert back to the original word payment. Under these circumstances, the accountant seemed to have been under the impression that this was a private arrangement, and did not concern their partners, more particularly as at first it was adverse to the company, and he did not make out the joint purse accounts in the corresponding form. Eventually, as the traffic increased, their actual "paid out" became less than that accounted for in the joint purse accounts. Nobody seemed to have discovered the discrepancy until the year 1901, when the matter was brought to their attention by the partners, and the board after giving the matter their full consideration, decided that the only course to pursue was to pay into the joint purse the balance that had thus accumulated. Seeing that the company had had a prosperous year, they thought it better to wipe out this sum at once, instead of spreading it over two or three years. They had, therefore, charged this amount of £33,992 13s. 11d. to profit and loss account, and the amount that remained over was naturally considerably diminished. The usual dividend and bonus absorbed £31,875, and the directors proposed to add £5,000 to the reserve, and carry forward £14 897 16s. 1d. to next year. The shareholders were, no doubt, anxious to hear whether he had any news to impart with reference to the renewal of the German concession, and he was happy to say that the managing director had just returned from Berlin, having concluded terms with the Imperial German Telegraph Department for the prolongation of the concession for 20 years from 1904, the document, now signed, only awaited the approval of the Imperial German Chancellor, and this they expected to receive during the course of a week or so. Shareholders were aware that the Russian and Persian concessions had been similarly renewed.

In reply to a question, the CHAIRMAN said they could not hope to see an immediate improvement in the telegraphic messages between this country and the East, and the conditions were not the same as between England and the Colonies. They must be content with small gradual success.

The report was adopted.

Baker Street and Waterloo Railway.

THE seventh half-yearly general meeting of the proprietors of this company was held on Thursday of last week at the Westminster Palace Hotel, Mr. Theodore J. Hare (Chairman) in the chair.

The CHAIRMAN said there were now about 1,300 proprietors on the register of the company. In moving the adoption of the report, he said they had only spent £54,142 on capital account during the past half-year, as pending the completion of the negotiations for the transfer of the contracts, the directors had not considered it desirable or prudent to spend more money than was absolutely necessary. The difficult work of driving the tunnels through the water bearing strata under the River Thames was now successfully completed, one tunnel having been carried as far as Waterloo Station, and the other not very far off from that station. It was now possible to descend at Waterloo Station and travel through the tunnel to

Oxford Circus, and come up to the ground again at that station. On March 7th last, an agreement was sealed with the Metropolitan District Electric Traction Company, Limited, to carry on the construction of the works, the contract sum to be paid in cash to the extent of the company's cash assets, and the balance in shares and debentures. The Metropolitan District Electric Traction Company, Limited, had now been absorbed by a company called the Underground Electric Railways Company of London, with a capital of £5,000,000, formed for the purpose of electrifying the District Railway, and constructing several of the tube railways in London, the Baker Street and Waterloo Company amongst the number. Messrs. Speyer Brothers, of London, in conjunction with Messrs. Speyer & Co., of New York, and the Old Colony Trust Company, of Boston, financial firms of the highest standing, were finding the whole of the capital of the Underground Electric Railways Company of London, and the necessary capital for the construction of the Baker Street and other tube railways. The shareholders were to be congratulated that the contract for the construction of the line would be carried out by a company of such high standing, the successful completion of the undertaking being thereby absolutely secured. The following works had been restarted. The driving of the western tunnel on the south side of the river was being pushed on in the direction of Waterloo, and the eastern running tunnel was being continued from Waterloo southwards. The Regent Street western tunnel, which had been stopped near Vigo Street, was being continued in a northerly direction. The driving of the east station tunnel at Oxford Circus would be commenced immediately the shield now in course of erection was finished, which would be in the course of a few days. Preparations were being made for starting the second station tunnel under the Embankment, where the company could get an interchange of traffic with the District Railway. It was expected that the line, at any rate as between the Elephant and Castle and Baker Street, would be completed in two years' time. A further agreement had been entered into with the new contractors by which they had taken over the liability for the payment of interest during construction, including arrears as from December 1st, 1900. Warrants for interest up to December 31st last would be issued on the 15th prox. The company's Bill, the object of which was explained at the Wharncliffe meeting on February 26th last, had been read a second time in the House of Lords, and it would shortly come before a Committee of the House. The several Bills which were being promoted in the present session and affected the company, were being carefully watched by the directors, and all possible steps would be taken to protect the interests of the shareholders. Mr. Arthur Willis, who had just joined the board, was nominated by the Traction Company, and was a gentleman of long railway experience.

Sir ALGERNON WEST seconded the motion, and the report was unanimously adopted.

Blackheath and Greenwich District Electric Light Company.

THE following is the report which the directors submitted for adoption at the meeting of the company on Tuesday, at Cannon Street Hotel:—

The directors herewith submit to the shareholders the balance-sheet and accounts for the year ended December 31st, 1901. The revenue account shows a credit balance of £2,150 4s. 3d., which with the balance brought forward £73 0s. 10d., the amount received for interest on money on deposit £107 3s. 4d., and the profit on the sale (less legal expenses) £3,917 1s. 5d., makes a total of £5,647 9s. 10d. After payment of debenture stock interest £3,952 15s. 1d., there remains a credit balance of £1,694 14s. 9d., which the directors recommend should be carried forward. The business of the company shows continuous and steady progress. On December 31st, 1900, the lamps connected were equivalent to 14,473 of 8-C.P. On December last the lamps connected were equivalent to 29,449 of 8-C.P. The number of consumers increased during the same period from 342 to 746. A satisfactory feature of the business is that a considerable demand for power has arisen, thus providing the company with a day load. The directors look forward with confidence to a considerable development in this direction. To meet present and prospective requirements it was deemed desirable to increase the capacity of the plant at the generating station, and orders were placed accordingly. The directors have every reason to believe that the consumers both for power and light are well satisfied with the supply, as extension orders are continually being received. In June last the Borough Council of Woolwich served the company with notice, requiring the sale to them of the Eltham portion of the company's undertaking situate within the said borough. Protracted negotiation ensued, with the result that the purchase price was mutually agreed at the sum of £5,600, to include capital expenditure within that area estimated at £2,110. Sir John A. Willox, M.P., retires from the board by rotation, and being eligible offers himself for re-election. Messrs. Chalmers, Wade & Co., the auditors of the company, offer themselves for re-election.

Sir J. A. WILLOX, M.P., presided at the meeting, and in moving the adoption of the above report, he said that the business showed continuous and steady progress. When the company began to supply in February, 1900, the number of consumers was 132, and the lamps connected were equivalent to 5,957 8-C.P. At the close of that year the consumers had increased to 342, and the lamps to 14,473. In the next year, 1901, the consumers had grown to 746, and the lamps to 29,449. Thus during the past year both consumers and the lamps have been more than doubled. This may fairly be regarded as satisfactory progress. It will be considered all the more satisfactory when it is stated that the progress still continues. Since January 1st last 104 new applications had been received and accepted for 4,100 8-C.P. lamps, which was far in excess of the figures of the corresponding period of last year. Several large installations were also being negotiated, and all the signs were of a hopeful character. The financial results also showed a distinct improvement. In the first year there was a small balance to credit of £73, but it must be borne in mind that this result was helped by the penalties recovered from the contractors for delay in completing the generating station. Without any such outside aid, the revenue account now showed a credit balance of £2,150. The total from current receipts for the year were £7,449. Of course, this was a comparatively small figure, but a large proportion of the consumers only began their supply late in the year, and the company had not, therefore, the advantage of their trade for any length of time. At present the business was decidedly better. During the first quarter of the present year the receipts from current amounted to £3,680, as compared with £1,880 in the same quarter of last year. The works cost also showed a favourable contrast, as the ratio diminished with the increase in the volume of business. One gratifying feature was the extension of the company's business in the supply of energy for manufacturing purposes. Manufacturers were finding it profitable to take power from the generating station, instead of setting up special plant of their own. It was also profitable to this company, because it kept the plant employed in the daytime and summer, when there was little demand for light. Numerous factories were springing up round the station, and there was every reason to anticipate that the company would find good customers among them. To provide for the immediate future they had enlarged the plant at the generating station, and the capacity of the plant was now adequate for all the probable requirements for a considerable time. As to the small change in the area of supply, the Woolwich Corporation gave notice to acquire the Eltham area over which the company had obtained power of supply. The company had done very little work in that district, because the population was sparse and the prospects of a lucrative business were not very roseate. They were not sorry to part with Eltham, and a fairly satisfactory settlement was amicably arranged with the Corporation of Woolwich. They paid the company for their whole expenditure on mains, &c., and also a sum of £3,500 as a compensation for disturbance. These amounts had been properly allocated in the balance-sheet. The capital account had been reduced by the amount received under that head, and only the balance had been treated as an available asset. They had also arranged with the Woolwich Corporation to continue to supply the consumers of Eltham with light, so that they still retained the business until the Corporation should find it convenient to provide a supply of their own, which would probably be a considerable time. The profit on the trading, and the sum obtained from the Woolwich Corporation, had enabled the company to cover the whole interest on the debenture stock, and to end the year with a credit balance of £1,760. The question the directors had to consider was how to dispose of that balance. They might have applied it in part to depreciation, but as the generating station of the company had been at work less than two years, that did not seem to be an urgent necessity; or they might have applied it in part to the reduction of preliminary expenses. That item would certainly have to be dealt with, but upon full consideration, the directors deemed it judicious not to appropriate the money at all, but to hold it in hand. There was good reason to hope that the next balance sheet, owing to the increase of business, and the consequent reduction of working charges, would show a favourable result, and the position would be further improved by the substantial amount now carried forward.

Mr. H. W. BOWDEN (managing director) seconded the motion, which was adopted.

The retiring director and auditors were re-elected, and the meeting closed with the usual vote of thanks.

Cuba Submarine Telegraph Company.

THE directors' report for the half-year ending December 31st, 1901, to be presented at the meeting to be held on May 7th, reads as follows:—

The directors beg to submit, duly audited, the balance-sheet and accounts for the half-year ended December 31st last. The total receipts for the six months were £11,963 9s. 7d., while the expenses amounted to £5,834 5s. 4d., leaving a balance of £6,029 4s. 3d., to which has to be add d £4,761 2s. 1d. brought forward from last account, giving a total of £10,790 6s. 4d. to be dealt with. The traffic receipts show an increase of £866 4s. 10d. as compared with the corresponding period of 1900. The dividend on the preference shares will absorb £3,000, and leave £7,790 6s. 4d., out of which the directors recommend the payment of a dividend at the rate of 4 per cent. per annum on the ordinary shares, free of income-tax, the balance, £4,590 6s. 4d., being carried forward to the current half-year. The broken Cape Cruz—Santiago section of the Manzanillo—Santiago cable referred to in last report was repaired on March 31st by the ss. *Newington* under the superintendence of Mr. Keith, and the directors have pleasure in reporting that the whole of the cables are now in good working order. The company's claim against the United States Government for reimbursement of the cost of repairing the cables cut during the Spanish-American War has not yet been settled, but the Bill in respect of the same is now pending in the House of Representatives, and it is hoped that it will be satisfactorily dealt with during the current session. With regard to the claim for payment of the subsidy of £2,000 per annum in respect of the coast cables, now in arrear since January, 1899, no reply has been received from the United States Government, but, in view of the change in the Government of Cuba, which has now been fixed for the 20th inst., the directors will take the earliest opportunity of pressing upon the local authorities the company's claim for payment of its subsidy in accordance with its concession.

Elmore's German and Austro-Hungarian Metal Company.

THE eleventh annual report, presumably intended to be presented at a meeting of shareholders, the date and place of which are not stated on the report which has reached us, reads thus:—"The directors beg to submit herewith the accounts of this company, and those of the 'Metall' Company, for the year ending December 31st, 1901. There is but little alteration in the accounts of this company, compared with those for the year 1900. The loan from bankers was reduced from £5,000 to £3,000 (now £2,500), and, as will be seen from the profit and loss account, there has been a reduction in the directors' fees and office salaries and rent, printing, &c. Patent charges are higher, owing to the biennial working of the Austro-Hungarian patents. The dividend declared at the last general meeting was duly paid to the preference shareholders and

the ordinary shareholders. With regard to the 'Metall' Company, the directors regret that, owing to the drop in the price of copper at the end of last year, a heavy loss was incurred whereby all the profit made was swept away and a loss made in addition. The result is extremely unsatisfactory, for a considerable saving had been effected in the cost of production, and, notwithstanding the great depression in trade in Germany, the company not only maintained its sales, but actually showed an increase. The copper market was extremely difficult to understand, and to either purchase or sell more than the actual requirements was a source of danger. The whole of the company's stock of copper has been written down to the low price which existed on December 31st last, since when the price of the metal has considerably increased. There have been increases in all the charges to profit and loss, none of which the directors could avoid. The factory was inspected by the directors on 15th ult., and was found to be in good condition, up-to-date, and working admirably. The trade in Germany would appear to be increasing, for the company is in receipt of orders largely in excess of any previous period. The directors have pleasure in stating that the Government has again given the company practically the sole contract for the next three years. This contract has been given after a trial of eight years of the company's products, and the decision of the Government implies satisfaction both with the goods and their delivery. The directors regret that their efforts to carry out the conversion of the debenture stock last year were ineffectual owing to the financial crisis in Germany, and the stringency of money in England. They had, therefore, no alternative but to ask the debenture-holders to extend the period of redemption to July 1st, 1904, and, at the same time, to permit of an increase in the amount from £75,000 to £100,000. A debenture stockholder (Mr. Walker) opposed the passing of the resolutions by the debenture-holders, and, immediately after their passing, issued a writ against the company, and a notice of motion asking for an injunction, which Mr. Justice Buckley refused. Mr. Walker appealed against this decision, and the Appeal Court, consisting of Lords Justice Vaughan-Williams, Romer and Cozens-Hardy, unanimously upheld Mr. Justice Buckley's decision. The directors in February last made an issue of stock, but in view of the litigation then proceeding and Mr. Walker's circular, such issue did not result in a large amount being applied for. Owing to the lower price of copper, the finances of the company are not at the moment pressing, and as the construction of the railway line into the factory has been deferred, the directors do not anticipate any financial difficulties. The retiring director on this occasion, Mr. John MacFarlan, being eligible, offers himself for re-election. The auditors, Messrs. Cooper Brothers & Co., also offer themselves for re-election."

The auditors' report reads as follows:—

In accordance with the provisions of the Companies Act, 1900, we certify that all our requirements as auditors have been complied with, and we report to the shareholders that we have audited the balance-sheet and profit and loss account (income and expenditure account). Nothing has been written off patents account since December 31st, 1897. The accounts of the business in Germany are kept there. We have seen a press copy of the balance-sheet of Elmore's Metall Actien Gesellschaft, December 31st, 1901, as certified by two local auditors. We are informed that, in addition to the remuneration charged in this company's profit and loss account, three of the directors have received from Elmore's Metall Actien Gesellschaft the sum of £62 10s. each by way of commission on loans raised on their guarantee for the benefit of the "Metall" Company, and that the managing director has received from the "Metall" Company remuneration as "Vorstand" of that company. Subject to these remarks, in our opinion such balance-sheet is properly drawn up so as to exhibit a true and correct view of the state of the company's affairs as shown by the books of the company.

COOPER BROTHERS & CO., *Chartered Accountants.* } *Auditors.*

London, *April 25th*, 1902.

Urban Electric Supply Company.

The fourth ordinary general meeting of the shareholders of this company was held on Thursday of last week at Broad Sanctuary Chambers, S.W., Mr. Francis E. Gripper presiding.

The Chairman said that this was the first meeting since the issue of the capital. The company was formed for the purpose of undertaking electric lighting and tramway concessions in a number of provincial towns, and the work which had to be done during the first three years of their existence was to obtain the Parliamentary powers authorising them to carry out the various undertakings which they had in view. This work of necessity occupied a very considerable time, involving the consents of the local authorities concerned which were generally obtained only after protracted negotiations as to terms and conditions. They had obtained their provisional orders at a very reasonable cost, and upon terms which would prove satisfactory to the company. The value of such provisional orders increased from year to year as they became more difficult to obtain. Having obtained the necessary Parliamentary powers, the public issue was made in June last, and the whole of the capital offered was subscribed for. A contract was entered into with Edmundson's Electricity Corporation, and substantial progress had been made towards the completion of works in different towns. At Hawick, which was the most important manufacturing town in the south of Scotland, the works were nearly completed, and had been supplying electricity for several months to a few important consumers for whom they arranged to run machinery in a temporary manner before the works were nearly finished. The company had already received applications for a large number of lights, and the prospects were very promising both for lighting and motive power. At Stamford, which was the only town in which the works had actually been completed and opened, they had nearly 4,000 lamps already connected or applied for. That was a very important example of the progress which had been made in the general use of electricity. Only a very few years ago it took three years to get 4,000 lights connected to the mains of a similar supply company in a country town three times as large as Stamford. Now they got them connected in six months, showing that the public had been educated up to the use of electricity as a necessity—not as a luxury. At Twickenham, which was one of their most important undertakings, the works were well toward completion, and they hoped to be able to supply current in June in time for the Coronation illuminations, for which they had some large applications in that district. They expected to supply several of the neighbouring places from their Twickenham station, negotiations being in progress with Teddington, Isleworth and Hounslow. The works at Weybridge were almost completed, and would be open within the next few weeks, and they had already received inquiries for nearly 3,000 lights. At Godalming, the works would be ready for opening in a few weeks. A contract had been secured for lighting all the public lamps in the district, and a large demand was expected from the Charter House Schools. At Dartmouth, works were being pushed forward upon a site which had been obtained from the Admiralty who had entered into a contract with them for the supply to the New Naval College, for which they required a very large number of lights. A contract had also been secured for the public lighting of the town. In Cornwall they had concessions for lighting both Camborne and Redruth, two of the most important towns in the county, and they also had a concession for an electric tramway about 4 miles long between the two towns. The power station was rapidly progressing, the work of laying the tramway had just been started, and they expected to commence supply during the summer. The district was the most important mining district in Cornwall, and they expected this to be one of their largest undertakings. At Glossop they had also concessions for both lighting and tramways, and the work there was about to be commenced. Considerable difficulty had arisen in obtaining a suitable site, but this had now been overcome and nothing prevented the work being pushed on and completed. Works at Grantham and Newton Abbot were also about to be commenced, suitable sites having been obtained. These facts showed that the work of the company was being most actively pushed on, and he hoped next year to present them with satisfactory results of the working of these undertakings. The accounts this year were not, of course, very elaborate. The balance sheet showed that only £1 per share had been called up, amounting to £64,000, but a large number of shareholders had elected to pay up in full upon allotment, with the result that £41,376 had been received on this account, making a total received of £104,687. £5,037 had been spent in purchase of land; £28,369 had been paid to contractors on account of works in progress; the cost of provisional orders was £14,448; the preliminary expenses of forming the company were £1,163. Then, under debtors, they had £40,631—loans and deposits, &c., to contractors. The larger portion of this amount represented money which they had lying idle at the time, and which was lent to Edmundson's Electricity Corporation at interest, but which had now either become due to them or would shortly become due to them under their contracts for works. Then there was an item of £7,696 for deposits with the Board of Trade, &c., which were statutory deposits during the construction of works, and which would be released as the works were completed. The profit and loss account this year was, of course, very brief, as they had not yet commenced supply operations. Under their agreement with Edmundsons, who had undertaken to work all their stations for a term of years, a dividend of 5 per cent. was guaranteed upon the share capital, and this dividend was duly paid on October 1st last, and again on April 1st. A further call of £1 per share was made on March 15th, and the remaining calls were now likely to be made at intervals of three months, and an application would shortly be made to the Stock Exchange for an official quotation of the shares.

Mr. Wm. Page seconded the adoption of the report, and this was unanimously adopted.

The two retiring directors having been re-elected, the proceedings terminated.

British Insulated Wire Company.

The sixth annual meeting was held at Prescot on Wednesday last week. Mr. E. K. Muspratt presided.

In moving the adoption of the report (of which an abstract has appeared in the Electrical Review), the Chairman stated that from certain causes the business of the company in the autumn had considerably declined, but as the directors had made special efforts, large orders had since been secured, and work was being well maintained. A considerable sum had been devoted to the acquisition of two concessions in Australia for electric lighting and traction. The directors had aimed at securing markets for their goods. These enterprises had not, up to the present, reached a profit-yielding point, but the directors regarded them as very valuable, and had no doubt they would soon yield handsome returns. Since the issue of the report, the negotiations which had been in progress for amalgamation with the Telegraph Construction Company, of Helsby, had been carried through, and the amalgamation completed. The Helsby Company was a profitable one, and the amalgamation would have the effect of doing away with competition, and of enabling the British Insulated Wire Company to tender for electrical installations fully instead of, as they had done in the past, for the cable portions only.

The motion was seconded by Mr. S. Z. de Ferranti.

An amendment of the report was suggested by Mr. Fred. Smith, affecting a proposed compensation to retiring directors, and was agreed to. The report was then adopted.

Messrs. Chalmers, Wade & Co. were re-appointed auditors.

British Columbia Electric Railway Company.

An extraordinary meeting of this company, held last week, passed the following resolutions:—

(1) Generally approving the recommendations contained in the chairman's report, dated February last; (2) authorising the directors to create and issue, in addition to the existing £250,000 of 4½ per cent. first mortgage debentures, further debentures to the nominal amount of £220,000; and (3) making certain alterations in the articles of association.

Stock Exchange Notices.—The Committee has ordered the undermentioned to be quoted in the Official List:—Brisbane Electric Tramways Investment Company, Ltd.—£400,000 4½ per cent. first debenture stock (redeemable), in lieu of the provisional certificates now quoted.

TRAFFIC RECEIPTS.

Blackburn Corporation Tramways.—The receipts for the week ending April 25th were £710; corresponding week last year, £717: decrease, £17. Total to date, £10,647; corresponding period last year, £9,310; increase, £1,337. Miles of track open, 10½.

Blackpool and Fleetwood Tramways.—The receipts for the week ending April 26th were £288; corresponding week last year, £347; decrease, £59. Total receipts to date, £3,489; corresponding period last year, £3,590; increase, £299.

Bristol Tramways and Carriage Company.—The receipts for the week ending April 25th were £4,241; corresponding period last year, £4,648; decrease, £407.

British Electric Traction Company.—The following returns are issued of the undertakings of this company for the week ending April 18th:—

Company.	Amount £	Comparison with corresponding week of last year. + £	Comparison with corresponding week of last year. − £	No. of weeks.	Aggregate. Amount. £	Aggregate. Inc. or Dec. + £	Aggregate. Inc. or Dec. − £
Devonport*	409	—	—	15½	5,939	—	—
Dudley-Stourbridge	693	148	—	15½	10,054	1,967	—
Gateshead	607	—	—	15½	9,791	—	—
Greenock-Pt. Glasgow	551	341	—	15½	6,068	3,399	—
Hartlepool	235	58	—	15½	2,947	204	—
Kidderminster ..	110	18	—	15½	1,517	154	—
Merthyr†	159	—	109	15½	2,963	—	294
Middleton*	277	—	—	3½	1,046	—	—
Oldham-Ashton ..	485	47	—	15½	7,716	29	—
Poole†	285	59	—	15½	5,114	18	—
Potteries	1,446	140	—	15½	21,121	829	—
Southport	226	91	—	15½	2,473	625	—
South Staffordshire†	736	62	—	15½	11,220	402	—
Swansea	409	49	—	15½	6,348	615	—
Taunton*	55	—	—	15½	845	—	—
Tynemouth§	205	41	—	15½	3,041	159	—
Wolverhampton Dist.	112	97	—	15½	2,040	1,318	—

* Not in operation last year. † Partly steam. ‡ Comparison from April 5th only. § Comparison from March 18th only.

Central London Railway.—The receipts for the week ending April 26th were £6,857; corresponding week last year, £6,612; increase, £245. Total receipts to date, £112,809; corresponding period last year, £104,596; increase, £8,213. Miles open, 6.

City and South London Railway.—The receipts for the week ending April 27th were £2,993; corresponding week last year, £1,848; increase, £1,145. Total receipts to date (17 weeks), £50,537; corresponding period last year, £33,974; increase, £16,563. Miles open, 6½; last year, 4½.

Dover Corporation Tramways.—The receipts for the week ending April 26th were £198 9s. 1d.; corresponding week last year, £203 4s. 10d; decrease, £4 15s. 9d. Total to date, £3,004 18s. 8½d.; corresponding period last year, £2,871 5s 5½d.: increase, £133 12s. 10d. Miles of track open, 8. Car miles run, 1902, 5,160; 1901, 5,063. Number of cars, 1902, 12; 1901, 11.

Dublin United Tramways Company.—The receipts for the week ending April 25th were as follows:—D.U.T. Co., £3,723 18s. 10d.; D.S.D. Co. £802 6s 6d.; total, £4,526 5s. 4d.: corresponding week last year—D.U.T. Co., £3 613 5s. 7d.; D.S.D. Co., £856 15s. 11d.: total, £4,470 1s. 6d.; increase, £56 3s. 10d.; aggregate to date, £67,932 7s. 3d.; last year, £64,485 3s. 10d.; increase, £3,447 3s. 5d. Mileage worked, 46.

Liverpool Overhead Railway.—The receipts for the week ending April 27th were £1,398; corresponding week last year, £1,591; decrease, £193. Total to date £23,889: corresponding period last year, £25,919; decrease, £2,030. Miles open, 6 miles 57 chains.

STOCKS AND SHARES.

Wednesday Evening.

With a Stock Exchange holiday dividing the week, and the most contradictory rumours afloat as to the coming of peace, the investment markets hardly hope to be busy, while the fact that a nineteen-day account is now dragging its way along provides another reason for quietude. There is, however, a fair amount of trade going on, and once more does the supply of Electrical Debentures fall short of the demand. Railway descriptions are almost unchanged, and the telegraph department presents but few outstanding features.

Metropolitan Electrics are a good market, and the price has risen to £16 buyers. A small speculative account is being built up in the shares, evidenced by the increasing number which are being carried-over at each settlement. We have heard a good deal of bullish talk as to Metropolitans being safe for 25, but although they did attain this figure once before, the possibility of their doing so now seems unlikely. If the Marylebone negotations (upon which the present rise is based) should be concluded as satisfactorily as some are hoping, Metropolitans might jump to 20, and that quotation seems to be a fair maximum of their utmost value. With reference to the Coronation illuminations, so far as can be seen at present, the gas companies will benefit more than the electric lighting, at all events in the City. South London shares, after their recent spurt, hang about 3, from which price they seem unwilling to budge.

A number of buying orders for Brush Electrical has raised the price of the shares to 1 1/16 bid, while the Preference are also better. The buying is of the sort usually described as knowing. Electric Constructions have found supporters after the unwarranted weakness which overtook the shares, but the prices show hardly any quotable change. The British Insulated Wire Company is offering more Preference and Debenture capital at par to its shareholders, and there can be little risk in taking it up, despite the dividend reductions on the Ordinary shares during the last two years. At present, the existing British Insulated Preference are quoted at 5¾ for the £5 share.

New issues are struggling to get out before next June. Of the South Wales Power Distribution Company we gave full details a fortnight ago, and the underwriting has now been completed. Those who assisted in this part of the company's financing received first-class tickets and hotel accommodation for the laying of the foundation stone at Cardiff. The full prospectus is now out. Another newcomer shortly to be presented is the Derby and Ashbourne Light Railway Company, with its thirteen-miles route, and there are several big "power" undertakings in the North of England whose bow to the public may be expected very shortly if the South Wales issue should prove a success.

Central London stocks continue very steady, and are all more easily sold than bought at the middle prices. Investors who are considering Twopenny Tubes as a channel for their money should bear in mind that, although the dividend on the Ordinary and Deferred is only limited by the profits which the company can make, a safe 4 per cent. from the Preferred stock is probably better worth having. Competition by the electrified District must, of course, be taken into account, and with the Central London working at its full capacity, there does not seem much prospect of an advance in the Ordinary dividend. District stock keeps about 33, unaffected by Mr. Perks's pathetic statements before Lord Windsor's Committee, and Metropolitan Consolidated has eased off to 78 upon the generally sagging tendency of the Home Railway market. City and South London is up to 70 upon the satisfactory character of the traffics.

So much is being heard of the octopus grasp of Mr. Pierpont Morgan that one is inclined to ask where all the money can come from to finance the oceanic and other schemes. Under the circumstances, it is not altogether surprising to hear of quietly persistent selling in British Electric Tractions, considering who it was that guaranteed the last emission of shares. With a dullish market, the disposal of these British Electrics is somewhat uphill work, but the price of the Ordinary keeps about 14.

In the telegraph list, there is more tone than business. Easterns have been down at 122 since our last notes were written, but the stock has sharply recovered. The Anglo-American group displays a firm tendency on the revival of business in the Yankee market, but already the prophets foresee no dividend on Anglo "A" for the current year. In the Submarine Cables Trust report, the principal feature is the omission of any reference to Signor Marconi. The net revenue for the past year amounted to £23,364. A little better showing for 1901 is made by the West Coast of America Telegraph Company, receipts being higher, and expenses lower than in 1900.

National Telephone issues remain dull. What strength there is left in them is noticeable in the Debenture descriptions. The 4 per cent. stock is 104½, and the 3½ per cent. Debenture about 95. It is worth pointing out that this latter stock is secured by a trust deed on the entire undertaking and property of the National Telephone Company; that it is irredeemable except in the event of the Government acquiring the undertaking, and if this last happens, it becomes redeemable at 103 per cent. on 6 months' notice being given. Those who argue that to all intents and purposes the acquisition has already taken place, should find this stock afford them considerable attraction.

SHARE LIST OF ELECTRICAL COMPANIES.—TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. †	Dividends for the last three years. 1899.	1900.	1901.	Closing Quotation April 23rd.	Closing Quotations April 30th.	Business done during week ended April 30th. 1902. Highest.	Lowest.
82,300	African Direct Telegraph, 4 % Debs.	100	...	...	...	99 —103	99 —103	...	...
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	...	...	...	3½— 4½	3½— 4½	...	...
119,700£	Amazon Telegraph 5 % Debs., Nos. 1 to 1,250 Red. ...	100	...	...	...	70 — 80	70 — 80	...	...
804,720	Anglo-American Telegraph	Stock	73/6	3½%	61s.	44 — 47	44 — 47 xd	44½	...
3,097,640	Do. do. 6 % Pref	Stock	6 %	6 %	6 %	87 — 89	88 — 90	90	87½
3,097,640	Do. do. Deferred	Stock	£1 7s.	5s.	2s.	7 — 7½	7 — 7½	7 7/16	7 5/16
44,000	Chili Telephone, Nos. 1 to 44,000	5	4 %	5 %	...	3½— 4	3½— 4	...	...
13,333,300$	Commercial Cable	$100	8 %	...	...	150 —160	150 —160	...	...
1,741,629£	Do. do. Sterling 500 year 4 % Deb. Stock Red.	Stock	...	...	...	93 — 96	93 — 96	94	...
16,000	Cuba Telegraph	10	7 %	...	...	4 — 5	4 — 5	...	...
6,000	Do. 10 % Pref.	10	...	...	...	13 — 14	13 — 14	...	...
12,931	Direct Spanish Telegraph	5	4 %	4 %	...	3 — 4	3 — 4	...	...
6,000	Do. do. 10 % Cum. Pref.	5	...	...	...	8½— 9½	8½— 9½	...	...
30,000£	Do. do. 4½ % Debs.	50	...	...	...	98 —102 %	98 —102	...	...
60,710£	Direct United States Cable	20	3½%	3½%	...	9½— 10½	9½— 10½	10 3/16	9¾
101,300£	Direct West India Cable, 4½ % Reg. Deb., within Nos. 1 to 1,200, Red.	100	...	...	...	99 —102	99 —102	...	...
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	...	122 —132	122 —132	125½	123½
1,930,807	Do. 3½ % Pref. Stock	100	...	...	...	83 — 86	83 — 86	85½	84
1,432,268£	Do. 4 % Mort. Deb. Stock Red.	Stock	...	...	...	105 —109	105 —109	108½	107¾
300,000	Eastern Extension, Australasia, and China Telegraph ...	10	7 %	7 %	7 %	12½— 13½	12½— 13½	13¼	12¼
320,000£	Do. 4 % Deb. Stock	Stock	...	...	...	108 —113	107 —112	107½	...
300,000£	Eastern and South African Telegraph, 4 % Mort. Deb. Nos. 1 to 3,000, red. 1909	100	5¼%	...	...	98 —101	98 —101	...	...
200,000£	Do. 4 % Reg. Mt. Debs. (Mauritius Sub.) 1—8,000	25	...	...	...	100 —103 %	100 —103	...	...
180,227	Globe Telegraph and Trust	10	5¼%	5¼%	...	8½— 9½	8 — 9	8 15/16	8½
180,042	Do. do. 6 % Pref.	10	...	...	...	12½— 13½	12½— 13½	13	12½
150,000	Great Northern Telegraph, of Copenhagen	10	...	15 %	...	27 — 29	27 — 29	28¾	...
75,000	Halifax and Bermuda Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	...	...	...	99 —103	99 —103	...	...
17,000	Indo-European Telegraph	25	10 %	10 %	10 %	35 — 39	36 — 40	37½	..
100,000£	London Platino-Brasilian Telegraph, 6 % Debs.	100	...	...	...	100 —104	100 — 104	...	...
72,680	Montevideo Telephone, Limited, Ord., Nos. 1 to 72,680 ...	1	2½%	...	...	½— ½	½— ½	...	...
86,492	Do. do. do. 5 % Pref., Nos. 1 to 86,492	1	5 %	...	...	¾— 1	¾— 1	...	
983,333	National Telephone, Pref. Stock	100	5 %	5 %	5 %	95 — 99	95 — 99	96⅞	96
200,000	Do Pref. shares	2	...	3⅛	3⅜	3⅛— 3⅜	3⅛— 3⅜	...	...
1,966,667	Do Def. Stock	100	...	60	64 xd	57 — 61	56 — 60	57	...
15,000	Do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	12 — 14	12 — 14	...	...
15,000	Do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	12 — 14	12 — 14	...	..
250,000	Do. 5 % Non-cum. 3rd Pref., 1 to 250,000	5	5 %	5 %	5 %	4⅞— 5⅛	4⅞— 5⅛	5 1/16	5
2,000,000£	Do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	93 — 96	93 — 96	94⅛	
500,000£	Do. 4 % Deb. Stock Red.	100	...	4 %	4 %	101 —105	101 —105	104½	102½
171,504	Oriental Telephone and Elec., Nos. 1 to 171,504, fully paid	1	5 %	6 %	6 %	15/16— 1 1/16	15/16— 1 1/16	...	...
100,000£	Pacific and European Tel., 4 % Guar. Debs., 1 to 1,000 ...	100	...	...	...	99 —102	99 —102	...	...
11,839	Reuter's	8	5 %	5 %	...	6½— 7½	6½— 7½	...	...
3,303	Submarine Cables Trust	Cert.	...	...	...	110 —120	119 —125	...	...
58,000	United River Plate Telephone	5	7 %	...	...	4⅜— 5¼	4⅜— 5¼	...	...
40,006	Do. do. 5 % Cum. pref. Nos. 1—40,000	5	...	...	...	4½— 5	4½— 5	...	...
179,947£	Do. do. 5 % Debs.	Stock	...	...	...	102 —105	102 —105	..	...
155,600	West African Telegraph, 5 % Debs....	100	...	...	...	99 —101	99 —101	...	...
30,008	West Coast of America, Nos. 1—30,000 and 53,001—53,008	2½	...	...	...	⅛— ⅜	⅛— ⅜	...	...
150,000£	Do. do. 4 % Debs., 1—1,500 gua. by Bras. Sub. Tel.	100	...	...	...	99 —102	99 —102	...	...
207,930	Western Telegraph, Ltd., Nos. 1—207,930	10	7 %	7 %	...	12 — 13	11½ — 12½	12 5/16	11¾
75,000£	Do do. 5 % Debs. 2nd series, 1906 ...	100	...	...	...	102 —105	102 —105	...	...
348,777£	Do. do. 4 % Deb. Stock Red.	100	...	...	...	99 —102	99 —102	...	...
88,321	West India and Panama Telegraph	10	⅝%	...	...	½— ⅝	½— ⅝	...	...
34,563	Do. do. do. 6 % Cum. 1st Pref. ...	10	...	...	...	5 — 5½	5 — 5½	...	...
4,669	Do. do. do. 6 % Cum. 2nd Pref. ...	10	...	...	...	3½— 4½	3½— 4½	...	...
80,000£	Do. do. do. 5 % Debs., Nos. 1 to 1,800	100	...	...	...	100 — 103	100 — 103	..	...

ELECTRICITY SUPPLY COMPANIES.

100,000	Blackheath and Greenwich Dist. Electric Light, Ord. ...	1	...	...	...	¼— ⅜	¼— ⅜	⅜	...
100,000	Do. 4½ % 1st Deb. Stock, Prov. Certs.	100	...	...	...	100 —104	100 —104	...	...
19,661	Brompton & Kensington Elec. Lt. Sup., Ord., 101 to 19,761	5	6 %	6 %	8 %	9 — 9⅛	9 — 9⅛	...	...
20,000	Do. do. 7 % Cum. Pref....	5	...	...	...	9 — 9½	9 — 9½	...	...
50,000	Charing Cross and Strand Electricity Supply	5	9 %	9 %	10 %	9 — 10	9 — 10	9⅝	...
50,000	Do. do. do. do. 4½% Cum. Pref.	5	...	...	...	5¼— 5⅝	5¼— 5⅝	5⅛	...
250,000	Do. do. do. 4% Deb. Stock Red.	100	...	...	...	105 —107	105 —107	106½	106
34,000	*Chelsea Electricity Supply, Ord.	5	6 %	5½%	4 %	5¼— 5⅜	5¼— 5⅜	5½	5¼
150,000£	Do. do. do. % Deb. Stock Red. ...	Stock	...	...	...	110 —113	110 —113	...	...
70,579	City of London Electric Lighting, Ord. 40,001—110,579...	10	4 %	0 %	5 %	8 — 9	8 — 9	..	...
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	...	12 — 13	12 — 13	12	...
400,000£	Do. 5 % Deb. Stock, Scrip. (iss. at £115) all paid	...	...	...	...	123 —128	123 —128	...	...
200,000	Do. 4½% 2nd Deb. Stock, Prov. Certs., all paid	100	...	...	...	103 —106	103 —106	...	...
40,000	County of Lond. & Brush Prov. Elec. Ltg., Ord. 1—40,000	10	4 %	4 %	4 %	8 — 9	8 — 9	...	...
20,000	Do. do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	...	12 — 13	12 — 13	...	...
400,000£	Do. 4½ % Deb. Stock, Prov. Certs (all paid) Rd. ...	...	...	...	..	107 —110	107 —110	109½	108⅞
35,500	Edmundson's Elec. Corp., Ord. Shares	5	6 %	7 %	...	6¼— 6⅜	6¼— 6⅜	...	...
20,000	Do. do. 6 % Cum. Pref.	...	...	...	...	6 — 6¼	6⅜— 6¼xd	6 7/16	...
120,000£	Do. do. 4½ % 1st Mort. Deb. Stock. ...	100	...	...	..	107 —110	107 —110	...	...
21,000	Kensington and Knightsbridge Electric, Ord.	5	11%	12%	10%	10 — 11	10 — 11	...	...
90,000	Do. do. do. 4 % Deb. Stock	Stock	...	...	...	101 —104	101 —104	...	...
110,000	London Electric Supply Corporation, Limited, Ord. ...	3	...	...	...	1¼— 1⅜	1¼— 1⅜	...	...
49,840	Do. do. do. do. 6 % Pref.	5	...	...	...	4¼— 4⅜	4¼— 4⅜	...	...
250,000£	Do. do. do. 4% 1st Mt. Db. Stock Rd.	Stock	...	...	...	95 —100	95 —100	...	...
98,769	Metropolitan Electric Supply, 101 to 62,500	10	5 %	6 %	6½%	15 — 16	15½— 16½	16 5/16	15 9/16
220,000£	Do. 4½% First Mortgage Debenture Stock	...	...	...	...	111 —115	111 —115	...	...
250,000£	Do. 3½% Mort. Deb. Stock Red.	Stock	...	...	...	97 —100	99¼ -100	...	...
8,652	Notting Hill Electric Lighting	10	7 %	7 %	6 %	14 — 15	14 — 15	...	...
40,000	St. James's and Pall Mall Electric Light, Ord.	5	14½%	14½%	14½%	14½— 15½	14½— 15½	...	...
20,000	Do. do. 7 % Pref., 20,081 to 40,080	5	7 %	7 %	7 %	8½— 9½	8½— 9½	...	...
150,000£	Do. do. 3½ % Deb. Stock Red. ...	100	...	...	...	98 —101	98 —101	...	...
12,000	Smithfield Market Elect. Supply, Ord.	5	...	...	...	1¾— 2¼	1¾— 2¼	...	...
50,000£	Do. do. 4 % Deb.	100	...	...	...	80 — 90	80 — 90	...	...
65,000	South London Electricity Supply, Crl.	5	...	...	...	3⅛— 3¼	3⅛— 3¼	...	...
109,518	Westminster Electric Supply, Ord.	5	13 %	10½%	10½%	11 — 12	11 — 12	12¼	11¾

* Subject to Founders Shares. † Quotations on Liverpool Stock Exchange.
‡ Unless otherwise stated all shares are fully paid. § Dividends paid in deferred share warrants, profits be ng used as capital.
Dividends marked ‖ are for a year consisting of the latter part of one year and the first part of the next.

SHARE LIST OF ELECTRICAL COMPANIES.—*Continued.*

ELECTRICAL RAILWAY, MANUFACTURING, AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last three years. 1899.	1900.	1901.	Closing Quotation April 23rd.	Closing Quotation April 30th.	Business done week ended April 30th, 1902. Highest.	Lowest.
		‡							
20,000	British Aluminium 7 % Cum. Pref.	10	...	...	...	4½ — 5½	4½ — 5½	...	...
300,000£	Do. do. 5 % 1st Mort. Deb. Stock Red. ...	Stock	...	...	...	88 — 92	86 — 90 xd	...	...
62,074	British Electric Traction	10	8 %	9 %	...	13½ — 14½	13½ — 14½	14 1/16	13 7/8
90,000	Do. do. 6 % Cum. Pref.	10	...	...	...	12¼ — 12¾	12¼ — 12¾	12⅝	12½
600,000£	Do. do. 5 % Perpetual Debenture Stock ...	Stock	...	...	...	124 —127	124 —127	126	125¾
70,000	British Insulated Wire Ord.	5	20 %	15 %	10 %	8 — 9	8 — 9 xd	8 9/16	...
70,000	Do. do. 6 % Cum. Pref.	5	...	...	...	5½ — 6	5½ — 5¾	...	...
50,000	¶Browett, Lindley & Co. (1899), Ord.	£1	...	8 %	...	13s. to 15s.	13s. to 15s.	...	...
50,000	¶ „ „ „ 6 % Cum. Pref.	£1	...	6 %	...	16/0 to 17/0	16/6 to 17/0	..	...
105,731	Brush Elecl. Enging., Ord., 1 to 105,731	2	5½ %	5 %	Nil	½ — 1	½ — 1	1 1/16	13/16
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	6 %	3 %	1¼ — 1⅝	1½ — 2	1 1/16	...
125,060£	Do. do. 4½ % Perp. Deb. Stock	Stock	...	...	...	101 —104	101 —104	...	...
125,000£	Do. do. 4½ % Perp. 2nd Deb. Stock ...	Stock	...	...	...	97 —100	97 —100	...	...
30,000	Callender's Cable Construction shares, Nos. 1—30,000 ...	5	15 %	15 %	...	17 — 18	17 — 18	...	...
40,000	Do. do. 5 % Cum. Pref.	5	...	...	...	5½ — 6	5½ — 6	...	...
90,000£	Do. do. 4½ % 1st Mort. Deb. Stock Red ...	Stock	...	...	...	111 —115	111 —115	...	...
1,969,800	Central London Railway, Ord. Stock	Stock	...	...	4 %	103 —106	103 —106	105½	104¾
440,100	Do. do. 4 % Pref. Stock	Stock	...	...	4 %	103 —106	103 —106	105½	...
440,100	Do. do. Def. do.	Stock	...	...	4 %	100 —103	100 —103	100	...
855,000	City and South London Railway	Stock	1¾ %	1¾ %	2 %	65 — 68	69 — 71	70½	67½
54,000	Crompton & Co., Nos. 1 to 54,000	3	7½ %	8 %	...	3 — 3½	3 — 3½	...	...
100,000£	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 red	...	...	...	...	100 —105 %	103 —108	...	...
99,261	Edison & Swan Utd. El. Lgt., "A" shares, £3 pd. 1 to 99,261	5	6 %	2½ %	...	⅛ — ⅜	⅛ — ⅜	...	...
17,139	Do. do. do. "A" Shares, 01—017,139 ...	5	6 %	2½ %	...	2 — 3	2 — 3	...	...
344,023£	Do. do. do. 4 % Deb. Stock Red ...	100	...	...	...	78 — 83	78 — 83	...	...
100,000£	Do. do. 5% 2nd Deb. Stock Prov. Certs. all pd.	100	...	...	...	82 — 87	82 — 87	..	...
112,100	Electric Construction, 1 to 112,100	2	6 %	6 %	...	1½ — 1⅝	1½ — 1⅝	1 7/16	...
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390... ...	2	...	...	...	2½ — 3	2½ — 3	2⅝	...
182,500£	Do. do. 4 % Perp. 1st Mort. Deb. Stock ...	Stock	...	...	...	97 —101	97 —101	...	...
18,000	General Elec. Co. (1900) 5 % Cum. Pref.	10	...	...	...	9⅜ — 10½	9⅜ — 10½	...	...
150,000	Do. do. 4 % Mort. Deb.	Stock	...	...	...	98 —101	98 — 101	...	...
35,000	Henley's (W. T.) Telegraph Works, Ord.	5	15 %	20 %	20 %	17 — 18	17 — 18	...	...
35,000	Do. do. do. 4½ % Pref.	5	4½ %	4½ %	...	5½ — 6	5½ — 6	5⅞	...
50,000£	Do. do. do. 4½ Mort. Deb. Stock...	Stock	...	...	...	111 —115	111 —115	...	...
50,000	India-Rubber, Gutta-Percha and Telegraph Works ...	10	10 %	10 %	...	21 — 22	21 — 22	21⅜	...
300,000£	Do. do. do. 4 % 1st Mort. Deb	100	...	...	...	99 —102	99 —102	..	...
37,500	†Liverpool Overhead Railway, Ord.	10	3⅛ %	3½ %	1½ %	4⅞ — 5	4⅞ — 5	...	...
10,000	† Do. do. Pref., £10 paid	10	5	...	...	10½ — 11	10½ — 11	...	...
7,500	Parker (Thomas), Limited, Ord., Nos. 1 to 7,500 ...	10	...	...	...	15½ — 16½	15½—16½	..	...
	§Rosling, Appleby & Fynn 6 % Cum. Pref.	£1	...	6 %	...	... — ...	19/0 to 20/0	...	...
37,350	Telegraph Construction and Maintenance	12	15 %	17½ %	20 %	34 — 37	34 — 37	36½	...
150,000£	Do. 4 % Deb. Bds. Nos. 1 to 1,500 Red. 1909 ...	100	... %	...	...	102 —105	103 —106	...	...
25,000	Telegraph Manufacturing, Ord. Nos. 1 to 25,000	5	12 %	12 %	...	10½ — 11½	10½ — 11½	..	...
20,000	Do. do. 5 % Cm. Prf. Nos. 1 to 20,000...	5	...	...	...	5½ — 6	5½ — 6	...	...
540,000£	Waterloo and City Railway, Ord. Stock	100	3 %	3 %	3 %	91 — 94	91 — 94	93	...

† Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. § From Bradford Share List.

LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED.

Consolidated Telephone Construction and Maintenance, 1/16—3/16.
National Electric Free Wiring, ⅞—1.

Oldham, Ashton, and Hyde Electric (£10 pd.), Ord., 14½—15.
Do. do. Pref. (£10 pd.), 10⅜—10⅝.

* From Birmingham Share List. ¶ From Manchester Share List.

Bank rate of discount 3 per cent. (February 6th, 1902).

MARKET QUOTATIONS, Wednesday, April 30th.

CHEMICALS, &c.		This week.	Last week.	Inc. or Dec.
a Acid, Hydrochloric .. .. per cwt.		5/-	5/-	..
a „ Nitric .. .. .. per cwt.		22/-	22/-	..
a „ Oxalic .. .. .. per cwt.		32/-	32/-	..
a „ Sulphuric .. .. .. per cwt.		5/6	5/6	..
a Ammoniac, Sal .. .. .. per cwt.		30/-	30/-	..
a Ammonia, Muriate (crystal) .. per ton		£33 10	£33 10	..
a „ „ .. per ton		£30	£30	..
a Bleaching powder .. .. per ton		£7	£7	..
a Bisulphide of Carbon .. .. per ton		£15	£15	..
a Borax .. .. per ton		£18	£18	..
a Bensole (90 %) .. .. .. per gal.		7/-	7/-	..
a „ (50/90%).. .. .. per gal.		5/6	5/6	..
a Copper Sulphate .. .. .. per ton		£20	£20	..
a Lead, Nitrate .. .. .. per ton		£24	£24	..
a „ White Sugar .. .. .. per ton		£31	£31	..
a „ Peroxide .. .. .. per ton		£27 10	£27 10	..
a Methylated Spirit .. .. .. per gal.		2/6	2/6	..
a Naphtha, Solvent (90% at 160° C). per gal.		5/6	5/6	..
a Potash, Bichromate, in casks.. per lb.		8d.	8d.	..
a „ Caustic (76/80%) .. per ton		£24	£24	..
a „ Bisulphate .. .. per ton		£35	£35	..
a Shellac .. .. per cwt.		125/-	125 -	..
a Sulphate of Magnesia .. .. per ton		£4 10	£4 10	..
a Sulphur, Sublimed Flowers .. per ton		£6 5	£6 5	..
a „ Recovered .. .. per ton		£5 10	£5 10	..
a „ Lump .. .. .. per ton		£5	£5	..
a Soda, Caustic (white 70 %) .. per ton		£10 15	£10 15	..
a „ Crystals .. .. .. per ton		£8	£8	..
a „ Bichromate, casks .. per lb		2¼d.	2¼d.	..
METALS, &c.				
b Aluminium Ingots, in ton lots per ton		£148	£148	..
b „ Wire, in ton lots per ton		£224	£224	..
b „ Sheet, in ton lots per ton		£191	£191	..
p Babbitt's metal ingots.. .. per ton		£75 to £125	£75 to £125	
c Brass (rolled metal 2" to 12") basis per lb.		6¾d.	6¾d.	..
c „ Tube (brazed) .. .. per lb.		8¼d.	8¼d.	..
c „ „ (solid drawn) .. per lb.		7d.	7d.	..
c „ Wire, basis .. .. per lb		7d.	7d.	..
c Copper Tubes (brazed) .. per lb		8¾d.	8¾d.	..
c „ „ (solid drawn) .. per lb.		9d.	9d.	..
g Copper Bars (best selected) .. per ton		£69	£71	£2 dec.

METALS, &c. *(continued.)*		This week.	Last week.	Inc. or Dec
g Copper Sheet .. .. .. per ton		£69	£71	£2 dec.
g „ Rod .. .. per ton		£69	£71	£2 dec.
e „ Electrolytic) Bars .. per ton		£63	£63	..
e „ „ Sheets .. per ton		£75	£75	..
e „ „ Rod .. per ton		£68	£68	..
e „ „ H.C. Wire per lb.		8d.	8d.	..
f Ebonite Rod .. .. per lb.		8/-	8/-	..
f „ Sheet .. .. .. per lb.		5/-	5/-	..
n German Silver Wire .. .. per lb.		1/5	1/5	..
h Gutta-percha fine .. .. .. per lb.		8/-	8/-	..
h India-rubber, Para fine .. .. per lb.		8/1½ to 8/2	8/1½ to 8/2	..
i Iron, Charcoal Sheets .. .. per ton		£18	£18	..
i „ Pig (Cleveland warrants) .. per ton		48/6	48/7	1d. dec.
i „ Forgings, according to size per ton		From £11	From £11	..
i „ Scrap, heavy .. .. .. per ton		47/6 to 50/-	47/6 to 50/-	..
i „ Wire, galvanised No. 8 .. per ton		£9 15	£9 15	..
g Lead, English Ingot .. .. per ton		£12	£12 to £12 2 6	2/6 dec.
g „ Sheet .. .. per ton		£13 10	£13 10	..
m Manganin Wire No. 28 .. .. per lb.		8/-	8/-	..
g Mercury .. .. per bot.		£8 15	£8 15	..
d Mica (in original cases), small .. per lb.		8d. to 9d.	8d. to 9d.	..
d „ „ „ medium per lb.		1/9 to 2/9	1/9 to 2/9	..
d „ „ „ large .. per lb.		8/8 to 7/8	8/8 to 7/8	..
p Phosphor Bronze, plain castings per lb.		11½d. to 1/2	11½d. to 1/2	..
p „ rolled bars & rods per lb.		1/- to 1/8	1/- to 1/8	..
p „ „ strip & sheet per lb.		From 1/2	From 1/2	..
o Platinum .. .. .. per oz.		£4 1	£4 1	..
p Silicium Bronze Wire .. .. per lb.		10d. to 1/-	10d. to 1/-	..
i Steel, Magnet, acc'd'ng to desc'p'n per ton		rom £15	to £40	..
i „ „ in bars		£5	£58	..
g Tin, block .. .. per ton		£1	£126 10 to £127 10	inc.
g „ foil .. .. per lb.		/8	1/8	..
n „ wire, Nos. 1 to 16 .. .. per lb.		1/7	1/7	..
p White Anti-friction Metals — "White Ant" brand .. .. per ton		£35 to £65	£35 to £65	..
j Yarns, 2/10s Grey Cotton, on sp'ls per lb.		7d.	7d.	..
j „ 6 lea. Flax .. .. .. per lb		5½d.	5½d.	..
j „ 3 ply 10 lbs. Russian .. per lb.		4½d.	4½d.	..
j „ 10 lbs. Russian, single .. per lb.		4¼d.	4¼d.	..
j „ 180 lbs. Jute rove .. .. per ton		£10 2 6	£10 2 6	..
k Zinc, Sheets, (Vielle Montagne brd.) per ton		£22 10	22 10	..

Quotations supplied by { a Messrs. G. Boor & Co. b The British Aluminium Co., Ltd. c Messrs. Thos. Bolton & Sons. d Messrs. F. Wiggins & Sons. e Messrs. Frederick Smith & Co.

Quotations supplied by { f India-Rubber, G.-P. and Teleg. Works g Messrs. James & Shakspeare. [Co., Ltd. h Messrs. Edward Till & Co. i Messrs. Bolling & Lowe. j Messrs. Walter H. Hindley & Co.

Quotations supplied by { k Messrs. Morris Ashby, Limited. m Messrs. W. T. Glover & Co., Ltd. n Messrs. P. Ormiston & Sons. o Messrs. Johnson, Matthey & Co., Ltd. p The Phosphor Bronze Company, Ltd

CURRENT SPECIFICATIONS.

C.—TYNEMOUTH EXTENSION.

SUMMARY.

Extent of Contract.—Supply, delivery, and erection of a motor-balancer as specified.

Duty of Motor-Balancer.—To be capable of dealing with an out-of-balance current of 50 amperes in the middle wire of a 440-volt three-wire direct current network.

Type of Machine.—Two separate direct current machines mounted on combined bedplates to run at a speed not exceeding 800 revolutions per minute.

Maximum Length.—Not to exceed 7 ft. 6 in.

Maximum Overload.—20 per cent. for periods not exceeding two hours.

Permissible Temperature Rise.—After six hours' full load with 50 amperes flowing, the temperature rise above surrounding atmosphere shall not exceed 65° F.

Period of Maintenance.—One year from date of delivery.

Efficiency.—At full and half loads to be stated.

Terms of Payment.—90 per cent. one month after trials on site have been completed, 10 per cent. six months later.

Arbitration Proposal.—See comments.

Date for Receipt of Tenders.—May 5th, 1902.

This specification has been prepared by Mr. C. Turnbull, the electrical engineer to the Corporation.

The technical requirements are, on the whole, clearly stated. It is stipulated that while slight modifications from the specification may be made, a higher speed machine will not be considered.

A regulating resistance with not less than 25 stops is to be arranged in the field circuit of both machines. The insulation resistance is to be not less than one megohm for the field circuit and ¾ megohm for the armature circuit.

Details as to the performance of the machine under varying conditions are to be given in the tender.

Referring to the general conditions, the terms of payment are acceptable, and the only clause which requires examination is the one dealing with arbitration. This is on the whole acceptable, though it reserves some matters for the sole decision of the engineer. In this case the only stated exception is the character of the tests; but on principle we hold that *all* matters respecting a contract upon which differences of opinion may arise ought to be as a last resource decided by an independent party, and not by one of the persons directly interested in the dispute.

PHYSICAL SOCIETY.

ORDINARY MEETING HELD APRIL 11TH, 1902.

PROF. S. P. THOMPSON, President, in the chair.

DR. R. A. LEHFELDT exhibited an "ELECTRIC HEATER." The apparatus consisted of a vacuum-jacketed glass tube containing water which was boiled by passing an electric current through a platinum spiral immersed in the liquid. Tap water is preferable to distilled water, because the small electrolytic action in the former case causes the boiling to proceed quietly. Different temperatures can be obtained by using other liquids.

MR. WATSON gave a list of liquids which he had found suitable for boiling electrically. He had used this method of obtaining a steady temperature in an apparatus for comparing thermometers.

MR. GRANT exhibited and described "AN APPARATUS FOR VAPOUR-PRESSURE MEASUREMENTS."

MR. J. T. MORRIS showed an experiment illustrating the use of cathode rays in alternate current work. The usual form of Braun tube was used, the rays falling upon a luminescent screen and forming a blue spot. A solenoid conveying an alternating current was placed near the tube. The varying magnetic field caused the spot to oscillate about its mean position. To determine the maximum value of the current a switch should be arranged to rapidly replace the alternating current by a continuous one. The continuous current should then be adjusted until the maximum excursion of the spot is the same as before, and the value of the current read off from an ammeter in the circuit. For accurate work the frequency of the discharge from the induction coil exciting the tube should be adjusted until it is almost exactly in synchronism with the alternating current. The unsteadiness of the spot of light in the zero position limits the accuracy of the measurements. Mr. Morris has tried to reduce the vibration by using an earthed aluminium diaphragm instead of a glass one.

MR. MORRIS also showed an experiment "ON THE GROWTH OF ELECTRIC CURRENTS IN AN INDUCTIVE CIRCUIT."

An E.M.F. of 0·8 volt was applied to a coil wound on a ring-shaped laminated iron core. When the current had attained its steady value the E.M.F. was reversed, and the variations of the current strength shown by an ammeter. About 20 seconds were required for the current to attain its maximum value in the opposite direction. A secondary coil was also wound upon the same core, and the effect produced upon the growing current by the closing of this secondary circuit was shown. Mr. Morris has determined curves of growth for different currents, and he explained how similar curves could be used to determine experimentally the hysteresis loss in transformers.

MR. GLAZEBROOK drew attention to the fact that this method has been applied with some slight modifications to the determination of the hysteresis loss in some 3,000-H.P. transformers.

MR. CROFT showed some apparatus and devices useful in teaching. An apparatus for producing and demonstrating the properties of three-phase currents was exhibited and described. The flatness of a piece of plate glass can be tested with a scribing block. The point is adjusted to touch the glass in one position. By breathing on the glass and moving the block about it is easily seen if the point leaves the surface.

MR. J. M. BARR said that the method could not be applied to steel. To test the flatness of a piece of steel he had made use of a small table with four legs placed upon the surface. One leg of the table was adjustable, and was made part of a circuit containing a microphone. If the ends of the four legs are placed in one plane, it is easy to test flatness by observing when the adjustable leg leaves the surface. The amount of the irregularity of the surface can be measured by having a micrometer attached to the movable leg.

The Society then adjourned until April 25th.

THE L.C.C. AND TUBE RAILWAY BILLS.

A COMPREHENSIVE and important report relating to the attitude of the London County Council towards the underground railway Bills of the present session has just been presented by the Parliamentary Committee. After summarising some of the recommendations of the Joint Committee of Parliament of last year, the report refers to the recent decision of the Earl of Morley, Lord Chairman of Committees, to omit from the Bills the clauses inserted by some of the promoters—apparently as a consequence of Paragraph 20 of the recommendations of the Joint Committee—proposing to authorise the County Council to aid in the construction of the lines. The decision of Lord Morley was due to the fact that it would not be in accordance with the practice of Parliament to allow such powers to be sought in the Bills without the general question having been considered by Parliament in the ordinary way. This decision has been accepted by the Parliamentary Committee in so far as it affects the Bills of the present session, but the matter will be carefully considered with a view to the Council being advised whether, and if so, what action should be taken in the future. As to the question of direct control and supervision of all projects, as suggested in Paragraph 19 of the recommendations of the Joint Committee, the report states that the President of the Board of Trade had been asked to receive a deputation, as it appeared to the Committee that it was necessary for something to be done in that direction in order to secure that the present schemes should be considered by a tribunal which would not labour under the many difficulties which will be experienced by any Select Committee, and which tribunal would have ample time and expert knowledge to deal with the proposals in a uniform and comprehensive manner. The Committee were, however, informed that no legislation on the question could be promised by the Government this session, and they therefore found themselves with no choice other than to consider each scheme as an ordinary railway Bill, and it only remained for them to afford any assistance in their power to the Select Committee in dealing with the Bills in the usual way.

The report proceeds to remark that the Bills have been considered from the many points of view in which they may affect the interests of London, particularly the manner in which the railways would meet the requirements of the public and assist in the development of London; their bearing upon the housing question, and the conveyance of persons of the labouring classes. It appeared quite clear to the Committee that all the schemes would not receive the sanction of Parliament, and, in the first place, they regarded the Bills from the point of view of the routes to be traversed, and afterwards directed attention to their financial proposals. This enabled the Committee to determine as to which of the schemes, in their opinion, it was desirable should be sanctioned by Parliament, and which of them were altogether undesirable, and in discriminating between the various proposals their conclusions are divided into four classes, namely—(1) schemes which, subject to certain conditions, should not be objected to by the Council; (2) schemes which, subject to certain conditions and to the attention of the Select Committee being drawn to the financial proposals, should not be objected to; (3) schemes which, subject to certain conditions, might be considered satisfactory except for their financial proposals, but which, on that account require to be strenuously opposed; and (4) schemes which on general grounds are unsatisfactory, and consequently should be opposed for the most part *in toto*. Before deciding as to amendments and modifications particular to the individual schemes the Committee arrived at the following conclusions, which are to be taken as conditions which should be more or less applicable to all the proposals before Parliament, and which are for the greater part peculiar to tube railway schemes :—

SUGGESTED GENERAL CONDITIONS.

That confluent junctions should not be allowed.

That, as far as possible, stations should not be constructed in such positions as would result in the discharge of passengers into very crowded thoroughfares.

That a model workmen's train clause, in a form which we have settled, should be inserted in the Bills. The effect of this clause will be to require workmen's tickets to be issued at all stations available by all trains, timed to arrive up to

8 a.m., at fares not exceeding 1d. for the single journey and 2d. return, the return tickets being available by any train starting the same day from any station within the distance covered by the ticket. In cases where two or more schemes are to be worked in connection with one another this clause should apply to such schemes taken together as if they were one line.

That in no case should there be any interference with or damage done to any of the Council's parks and open spaces.

That unless promoters have within 18 months from the passing of the Act conferring statutory powers upon them substantially commenced to carry out their undertaking and have completed and opened their undertaking for the use of the public within the period prescribed by such Act, their power shall cease to be exercisable except as to so much of the undertaking as shall then have been completed, unless the time allowed be prolonged by the special direction of the Board of Trade, the exercise of the powers with regard to the works completed being left to the decision of the Board of Trade.

That all tunnels should be properly ventilated.

That adequate accommodation for the public with respect to entrances to and exits from stations, booking offices, waiting rooms, &c., should be provided, and that the Council should be empowered to decide as to whether such accommodation adequately meets the requirements of the public.

That a system of electric lighting in tunnels should be provided by the company in such a manner as to enable lights to be turned on from any signal box in the event of an accident or stoppage of trains occurring in the tunnel, so that passengers would be enabled to see to walk to the nearest station, the current supplying these lights not being liable to be cut off in the event of any accident to the main supply of current for electrical traction.

That a footpath should be provided along the tunnels between the metals so that, in the event of any accident or stoppage of trains, passengers could walk in safety to the nearest station.

That the use of any inflammable materials in the construction of cables, platforms, carriages, and other things in or about the tunnels and stations should be avoided as far as possible.

That, if practicable, some automatic arrangement should be provided so as to render it impossible, in the event of a train being stopped between two stations, for the following train to run into it.

That the fact of Parliamentary powers being given to the promoters of a tube railway scheme should not prejudice the Council's interests when seeking powers at any future time to construct tramways or shallow tramways along the same routes.

That the Council's approval to the design of all buildings, structures and works proposed under the Bills and fronting upon public roads or streets should be required.

That buildings used partly as stations and partly as domestic buildings should be in accordance with the provisions of the London Building Acts relating to domestic buildings.

That where it was proposed to break up the public way to carry out works, moving machinery should be screened from view and the disfigurement of the locality by the erection of unsightly hoardings should be prevented.

That where any proposed railway would intersect lands in London likely to be developed by the formation of streets thereon, the company should be required to make bridges of sufficient width and headway or such other provisions as would admit of new streets on either side of such railway being constructed.

That the promoters should undertake to facilitate the construction of interchange stations with tube railways existing, or proposed, or to be hereafter proposed and constructed, and through booking on the lines with which opportunities for interchange are afforded.

That the Council should have control over the subways to be constructed under the Bills for the use of the public.

The questions of subsidence and vibration which arise in connection with the Bills, have also received careful consideration. After referring to the report of Lord Rayleigh's Committee and the discussion in the House of Lords on the subject, the Committee remark that they do not think the Council should endeavour to obtain the insertion of any clauses in the Bills which would hamper promoters, and place difficulties in the way of the carrying out of the undertakings. Although a reference to vibration has been included in a clause prepared by the Committee to deal with subsidence, and to provide for the payment of compensation in respect of any structural damage or annoyance or injury suffered in consequence of the construction of tube railways, it is understood that the Board of Trade will advise the Select Committee as to the action which should be taken in the matter. The Board will also deal with several of the matters included in the before-mentioned general conditions. As a further matter applicable to the Bills, the Committee have given instructions for the question of the ordinary fares to be charged on the railways to be brought before the Select Committee. In addition to these general requirements, in many Bills clauses are needed, similar in many respects to those which it is the practice of the Council to seek in ordinary railway and other Bills concerning London. These relate to the protection of sewers, the application of the provisions of the London Railway Acts, and other matters which it will be unnecessary to mention in this place. Proceeding now to consider the proposals individually, the Committee submit that the following, subject to certain conditions, should not be objected to:—

1. Baker Street & Waterloo Railway Bill.
2. Central London Railway (New Lines) Bill.
3. Edgware & Hampstead Railway Bill.
4. Great Northern & City Railway Bill.
5. Great Northern Railway Bill No. 2.
6. Great Northern & Strand Railway Bill.
7. Islington & Euston Railway Bill.
8. North-West London Railway Bill.

The special conditions in the case of the above Bills relate mainly to an extension of the Central London line from Hammersmith to Barnes, the construction of interchange sections, the widening of roads, &c. The schemes not to be objected to, subject to certain conditions, and to the financial proposals being placed specifically before the Select Committee, are as follow:—

9. City & Crystal Palace Railway Bill.
10. City & North-East Suburban Electric Railway Bills, Nos. 1 and 2.
11. North-East London Railway Bills, Nos. 1 and 2.

The schemes to be strenuously opposed in consequence of their financial proposals, but which otherwise might be considered satisfactory, are the King's Road Railway Bill and the West & South-West London Junction Railway Bill. There are six other schemes which, on general grounds, are considered to be unsatisfactory, and which are to be opposed, for the most part *in toto*. The first is the Brompton & Piccadilly Circus (new lines and extensions) Bill. The promoters of this scheme have not commenced to carry out any portion of their undertaking, authorised in 1897, and having considered the project both in regard to the route and the financial proposals, the Committee are of opinion that Parliament should be asked to reject the Bill. There is a probability of the proposed southern extension of the authorised line of the Great Northern & Strand Company being abandoned, and in the event of such an occurrence, it may be necessary to reconsider in some respects the action to be taken on this Bill.

In the case of the second scheme, which refers to the Charing Cross, Euston and Hampstead Railway Bills Nos. 1, 2 and 3, the Committee do not think Parliament should sanction the extension of the line to Archway Road and Golder's Green, but the lines already authorised would prove useful if built with due regard to economy. The company should, however, be required, in accordance with the view expressed by the Joint Committee of last session, to substitute an interchange station for the confluent junction which would be formed in Camden Town by their already authorised lines from Kentish Town and Hampstead. Special attention should also be drawn to the financial proposals, which do not appear to have been arrived at with proper regard to economical working, namely, about £1,000,000 per mile for the new lines.

The Committee consider that the Charing Cross, Hammersmith and District Electric Railway Bills Nos. 1 and 2, which project lines for almost their whole length along the same route as those proposed by the Central London Railway Company, and which would serve almost the same districts, should be rejected. With regard to the fourth scheme—the City and Brixton Railway Bill—the Committee state that the company have not carried out the undertaking authorised in 1898, and they express the opinion that Parliament should be asked to refuse to grant an extension of time.

Under the London United Electric Railways Bill, the route to be traversed to a great extent is similar to that covered by the new proposals of the Central London Railway Company. The Committee do not think the north to south communication between the Marble Arch and the district adjacent to the north end of Wandsworth Common should be sanctioned, and having arrived at the conclusion that the scheme of the Central London Company is more calculated to meet the public requirements, they suggest that Parliament should be asked to reject the other portion of this scheme. The last proposal—that of the Piccadilly and City Railway Bills Nos. 1 and 2—is another scheme which seeks to traverse a route similar to that covered by the project of the Central London Company, the capital expenditure working out at £975,000 per mile. In the opinion of the Committee, Parliament should also be asked to reject these Bills.

In conclusion, the Parliamentary Committee announce that with the object of arrangements being come to with promoters, and the insertion of amendments to give effect to their conclusions, they have given instructions for negotiations to be entered into with the several companies concerned with a view to avoiding, as far as possible, contests before the Committees of Parliament on the Bills.

At the Council meeting on Tuesday last week the above report was considered.

Mr. J. W. Benn drew attention to what he termed the unfortunate position of London, owing to the failure of the Government to carry out the proposals of the Joint Committee of last year, and he stated that it was important for them to make it known that the Council declined to share the responsibility for the muddle due to the method adopted for dealing with the matter of tube railways. The most important recommendation of that Committee related to control and supervision of a more direct character, but he was sorry the Government had not seen its way to constitute a body for that purpose. It was monstrous that 30 years after the passing of the Tramways Act they should allow London to be scrambled for without anyone to protect the interests of London from a central point of view in regard to underground electric railways.

After lengthy discussion the action of the Committee was approved without any dissentients.

INSTITUTION OF ELECTRICAL ENGINEERS.

AIR-SPACED CABLES: THEIR TREATMENT AND USE.

By G. E. Fletcher, A.M.I.C.E., M.I.E.E.

(Abstract of a Paper read before the Manchester Section, April 15th, 1902.)

In the first place it is necessary to briefly consider the essentials for a specification. The conductors being solid should be specified in the ordinary way. The dielectric of paper should be applied to each separate conductor, so as to effectively insulate it from any neighbouring conductor, at the same time giving a free air-space between the paper and the conductor. This paper case should be whipped with a hemp twine of about ½ in. pitch, so as to prevent it opening and exposing the conductor. When the conductor so covered is laid up with another conductor, the same form of paper case should obtain as nearly as possible as before laying up, and the same condition should be maintained in laying up the pairs to form the complete cable. Each layer of the cable should be separated by a spiral wrapping of paper, and the whole treated as described above, before the lead sheath is applied.

The paper employed should be uniform in texture and thickness, long fibred, strong, free from metallic particles and other deleterious substances, and not less than 4 mils. in thickness. A strip 1 in. wide must bear a strain of 4 lbs. for each mil. of thickness.

The width and thickness of the paper should vary in proportion with the weight of wire used, viz.:—

64 lbs. conductor.	.	4 mils. thick.	1 in wide.
150	„	5 „	1¼ „
200	„	6 „	1½ „

Where different coloured papers are used, care should be taken in the choice of the colouring matter employed, otherwise the insulation resistance may be considerably lowered.

The cable must be thoroughly dried at a temperature not exceeding 225° F. after having been layed up ready to receive the lead sheath.

The minimum radial depth of the lead sheath should be 100 mils. for a 5 pair, and should not necessarily exceed 150 mils. for any larger cable. The sheathing should be capable of withstanding an internal pressure of 75 lbs. per sq. in.; the lead used to be new English pig.

It is evident that moisture is the greatest enemy to these cables, as the slightest trace of dampness will at once impair the insulation resistance; therefore it is of the utmost importance that the lead sheath should be free from pinholes or flaws of any description. It is said that as the lead is applied hot, if the cable be sealed immediately the process of sheathing is completed, and plunged in a tank of water at 60° F., a vacuum is produced sufficient to cause the water to penetrate any pinhole or flaw there may be, but I am doubtful on this point, and prefer the test for such defects to be of a more positive nature, *i.e.*, the cable should be tested under an air pressure of 20 lbs. per sq. in., and when under this pressure, passed slowly through an observation trough at least 18 ft. long, containing water, so that any pinhole or flaw may be detected without injury to the cable. The defect can then be easily rectified. The air during this test must be perfectly dry.

The insulation resistance between wire and wire and wire and sheath should not be less than 10,000 megohms per mile, and the electrostatic capacity for—

64 lbs. conductor	...	·09 microfarad per mile
100 lbs. and over	...	·1 „ „

Having now briefly considered the conditions and precautions necessary for the production of air-spaced paper-insulated cables, let us consider the question of protecting them from the destructive effect of lightning. It would appear to some people that, as such cables are laid underground, the effect of lightning would be nil; but, seeing that they are used in connection with telegraph and telephone circuits, occasions must frequently arise when they are interpolated with aerial lines or form the tail-end of the same. Many cases are known to me where they are permanently interpolated, and it will thus be seen that very careful consideration must be given to their protection from this form of destruction. Whatever the form of lightning arrester used, it is essential that the air-space at any point throughout the cable must always be greater than the spark-gap in the arrester; otherwise the cable becomes the arrester, and the arrester proper ineffective.

The junction boxes in use were designed by me some four and a half years ago. They have been made in the following sizes:—2, 5, 10, 15, 20, 30, 40, and 80 pairs, the two-pair size being constructed of wood, the remainder of cast-iron.

For the lightning arresters the thickness of the mica plates used is about 16 mils. At the present time I have 1,331 cast-iron boxes in use, containing 26,746 arresters. In practice a box is fixed at each end of the cable, no matter how long or how short; but should any cable, however, exceed 440 yards in length, the like boxes are inserted every quarter of a mile. By adopting this practice it is quite easy, in case any portion of the cable is damaged, to cut that length out temporarily with a rubber insulated cable until the fault is removed. The boxes, before being used, are heated, and when hot treated with a mixture of Chatterton's compound and ozokerite inside to prevent sweating. Unless this is done thoroughly sweating takes place, and if only to a very small degree, loss is at once set up in the arrester.

That these boxes fulfil their object is evinced by the fact that the men whose duty it is to periodically examine them have repeatedly observed connecting strips and earth plates considerably pitted by lightning discharges, and in one particular instance several plates in the same box were so pitted on three separate occasions, the length of cable in this instance being 39 yards. In none of the cases has the working of the cable, either in part or whole, been interfered with.

The length of cable in use on the London and North-Western Railway Company's system at the end of February this year was practically 90 miles, varying from one pair to 40 pair, representing in single conductor about 1,700 miles. All are jointed and protected on the plan described above by 1,331 junction boxes, containing 26,746 lightning arresters.

Some few years ago it was decided to gradually remove all the company's aerial wires where they crossed the main line of rails or station yards and place them underground; for this purpose air-spaced cable was adopted, and its use was gradually extended along the railway where it was difficult to erect a stable overhead route, owing to want of space, also through tunnels, along retaining walls, &c.

To accomplish the above, various lengths of cable must be employed ranging from 20 yards upwards. These, where buried, are to-day always laid solid in wood trunking, the trunking being grooved out of solid timber, each groove being very little larger than the cable to be laid in it, so that the heating effect of the pitch shall cause as little expansion of the cable as possible, consistent with a sound job. I consider it is very unwise to draw these cables in, and so far as possible I do not allow the practice of drawing, but insist that all cables shall be laid. This I determined on after an experience of drawing a 10-pair cable into iron piping, the length of which was 300 yards, when the lead sheath gained over the conductor no less than 18 ft. If the practice of anchoring the lead and conductors together is resorted to, the form of the cable becomes distorted more or less throughout its length, and where the lead gains to any extent over the conductor a tendency towards pinholes must be produced. I am of opinion that this is one of the causes why it is found necessary to pump dry air through cables frequently—a practice to which I have not yet had to resort. Another reason for the necessity of pumping dry air through cables in general practice is that the cables are drawn into pipes at drawing-in boxes and the atmosphere in these being subject to the same changes as that outside, in my opinion sweating takes place inside the lead, but only to a very small degree, whereas if the cables are laid solid and buried at a depth of, say, 3 ft., this difficulty does not occur. Although we do not resort to the pumping of air through the cables, we have not experienced any failure from the cause mentioned above; the majority of faults have been occasioned by water in some way getting into the junction boxes, and below is a list of all the failures which have occurred during the last 15 months—the total during that time being 37.

Faults in Junction Boxes.

Disconnection through bad soldering on to connecting strips	...	1
Earth, through clamping screws working loose, allowing connecting strip to come in contact with brass pillar	...	4
Bad mica	...	2
Water in junction boxes	...	14
		21

Faults in Cables.

Perforated lead by chemical or electrolytic action		8
By pick or bar being driven into cable	...	3
Subsidence	...	5
		16
Total	...	37

One difficulty that has presented itself is the sealing of the rubber insulated leads where changing from open to cable work, and in all the cases of failure due to water getting into the junction boxes it has been due to defective sealing in the glands through which the rubber wires are led away. Experiments are now being carried out with a special gland so constructed as to receive the rubber insulated cable, a short length of which, where it is passed through the gland, is vulcanised up solid so that a mechanical joint can be made.

The perforation of the lead by chemical or electrolytic action only happened in the earlier cables put down, as they were then laid in wood troughing not pitched, and it was from the experience so gained that the laying on the solid system was adopted.

In case of failures from subsidence these have mostly occurred on entirely new railway works, and in all cases the cables passed under running lines.

All our cables are maintained by special staff from headquarters, the district officers and their men having nothing to do with the same. By this method we get uniformity in the manner of carrying out all the work in connection with cable laying. Where the cables enter signal cabins, offices, &c., a distributing box is provided, which is under the maintenance of the district men, who have no occasion whatever to interfere with the junction boxes. The latter are only opened by the cable staff. Rubber insulated wires are led from the junction box to the distributing box.

At the present time we have cables laid down in 243 different localities all over the line, and the number is steadily increasing month by month.

During the first period of using these cables I went so far as 40 pair, but have since determined in no case to exceed 15 pair, and prefer to employ a 10 and a 5 pair even in place of the former, as by doing so I do not put all my eggs into one basket, and, further, the cable can be handled in longer lengths, and very much more easily. The difference in first cost is practically negligible, and that of laying inappreciable. Any additional requirement can be met by leaving spare wires in the proportion 1 to each 4 working, and when these are used up it is an easy matter to lay an additional cable if such becomes necessary.

In conclusion, let me say that I see no reason to cause me to regret having adopted air-cored cables—rather the opposite—but to push on with their use as quickly as possible.

TESTS ON THE NERNST LAMP.

By R. P. HULSE, Bowen Scholar, Birmingham University.

(*Paper read at Birmingham, March 19th*, 1902. *Communicated by Dr. D. K. Morris.*)

(*Concluded from page* 702.)

USUALLY the iron resistance will be destroyed before the lamp in candle-power voltage tests, especially if the lamp be new; and to burn the rod out a special resistance had to be made, the observations commencing where the others left off.

The candle-power and watts on rod curve which can be plotted from these results show that the candle-power varies as the 2·6th power of the watts expended on the luminous rod. This value was taken from the results given by two old lamps, and satisfies these to within 1 per cent. for a range of from 60 to 100 watts.

Variation of Resistance with Watts Expended. 1. *For Luminous Rod.*—The watts, being the rate of dissipation of energy, are a measure of the temperature, and the resistance varies with the temperature; so that by plotting resistance against the watts expended on the rod, we have a curve connecting resistance with some power of the temperature, but no absolute values of temperature can be given. [See Curves VIII. and VIIIa. c.p.-watt curve.]

2. *Iron Steadying Resistance.*—A similar curve can be plotted for the iron resistance, and the similarity between this curve and that obtained by direct observation at different temperatures* is very striking.

The life of the steadying resistance cannot be correctly stated, but is very considerable. One used for over 1,000 hours in connection with normal pressure tests has deteriorated very little.

Behaviour of Luminous Rod.—The rod always becomes crystalline after being in use for a short time, and near the negative end was blackened, changing through grey to a faint yellow at the positive end. In all cases where life tests have been made there was a white deposit in glass globe during first part of life, and more especially in the case of the over-run lamp.

It was noticed that at certain periods a faint singing or hissing sound is emitted by the luminous rod. This occurs particularly with new or over-run lamps, and was accompanied with a fluctuation (usually a diminution) of current amounting to about 2 per cent., and an even greater alteration of the power supplied to the rod. It would be very interesting to know how this sound is caused, and whether it is associated with the crystallisation referred to.

These fluctuations of current occur under all conditions of testing, but when they were not great the sound could not be detected. The current sometimes varied 2 or 3 per cent. when the external pressure on the lamp terminals was absolutely steady.

In all the life tests the end of the test was determined by the breaking away of the positive connection at the platinum wire. This is at the lower end of the rod according to the instructions sent with each lamp Of seventeen burners tested, none but three ended at all prematurely; and these three, curiously enough, were being *under*-run, and, in fact, were undergoing the earlier stages of a regulation test with gradually increasing pressure.

Removal of the globe appears to cool the luminous rod, increasing its resistance and decreasing the current supplied by about 1 per cent.

When once started it is found that a very small current will suffice to heat the rod sufficiently to make it conduct. In this way a burner was observed to give only ·175 c.p., the current taken being ·193 amp. and pressure on lamp 87·4 volts.

A new luminous rod when normally burning has a specific resistance of about ·7 ohm per centimetre cube (about 100 times that of a carbon filament). The average of three rods which had each run for 450 hours was 1·06 ohms per cm. cube.

Heating Coil and Automatic Switch.—The heating coil, which consists of a clay spiral (arranged around the luminous rod), closely overwound with fine platinum wire, was tested by continuously running it on 110 volts for over 48 hours. No alteration of the heating current occurred during this period, which corresponds to lighting the lamp a very large number of times—since the lamp only takes about half a minute to light up.

It was also found that the period required to heat the rod to the point of conducting was not sensibly increased after the starting of the lamp 120 times (the rod being allowed to cool between each start); while the diminution in candle-power of the burner due to this frequent heating and cooling was no greater than would have been the case if the lamp had been continuously run for a corresponding time.

The heating coil will plainly last longer than the rod, and it should be possible to use up heating coils by replacing the rod alone.

At no time has the automatic switch failed to act; nor has its contact given any trouble.

In conclusion, there seems to be a wide field for the Nernst lamp where fairly large candle-powers are required and where power is not cheap.

The Nernst lamp will give on the average throughout a life of 400 hours at least ·48 c.p. per watt expended, as against not more than ·28 c.p. per watt in the case of good glow lamps. The cost of renewals would appear to be not more than three times as much for the Nernst as for the glow lamp, allowing for the shorter life of the former. In a 100-watt Nernst lamp (see Curve II.) the total energy used is over 35 units during economical life; and at 4d. a unit this costs 11s. 8d., or, say, not more than 15s. when all expenditure due to renewal of the burner is taken into account.

Thus the Nernst lamp will furnish 1,000 c.p.-hours at a cost of 11d.; while 1s. 3d. is the approximate cost of the same amount of illumination from good glow lamps. In this comparative estimate the cost of renewals in each case has been included, the price per unit assumed to be 4d., while the glow lamp has been taken at an average of 3·6 watts per candle-power throughout a life of 700 hours.

If the glow lamp be run for a longer period, or the price of the unit increased, the case will be all the more favourable to the Nernst lamp.

Under-running might pay where power is cheaper, owing to the increased life; and this, in spite of the low efficiency towards the end (say after about 800 hours; see Table III.).

Over-running of the lamps, on the other hand, is, as stated above, not economical.

The rapid falling off in the efficiency of the lamp under normal conditions after 300 hours seems to show that after this time it would be better to replace the iron resistance shown by one of a smaller value, and so maintain the candle-power at a steady value throughout the life.

My best thanks are due to the Birmingham University authorities, for the current used in these tests and the use of instruments and apparatus; also to Dr. D. K. Morris for facilitating the carrying out of these tests, and for kind assistance in finishing this paper.

* See *Phil. Mag.* September, 1897.

Discussion.

Dr. Morris opened the discussion, and said that the life tests were of interest as showing clearly that they had a lamp, which, while its life was only half that of the ordinary glow lamp, had a much greater average efficiency throughout its life, giving 50 per cent. more light for the same expenditure of power, while the increased cost of renewals was only a small matter as against this 50 per cent increase in economy.

Mr. J. C. Vaudrey thought that the lamp was, to a great extent, in the experimental stage. Apparently the economical life of the lamp finished after 150 hours. Another drawback was the size of the lamp; it was about 50-c.p., while the size most in demand was the 16-c.p. glow lamp.

Mr. Hookham inquired whether the comparisons drawn in the paper between the Nernst lamp and the glow lamp were with 50 or 8-c.p. glow lamps, to which Mr. Hulse replied that a 40-c.p. glow lamp had been used. Continuing, Mr. Hookham said that according to the author, you get with the Nernst lamp for 1s. what you can obtain with the ordinary carbon filament for 1s. 3d., and you have no end of extra attention and trouble in order to save the odd 3d.

Mr. A. H. Bates thought the hissing sound might be due to the changes in conduction of a current through the heated air surrounding the luminous rod, *not* to the changes in the rod itself. It was probable that there was a discharge through the gases surrounding the luminous rod which caused the hissing sound and also the variation in the current.

The Chairman (Mr. Hy. Lea), said he did not think that the glow lamp was properly appreciated from the point of view of its being intended to be used at the voltage for which it was made. It seemed to be inseparable from a large-distribution system that the voltage should be anything but constant, and lamps anything but long lived in consequence. It would have been more satisfactory if the Nernst lamp had shown itself to be independent of variations of pressure. With the Nernst lamp there were three possible causes of breakdown:—(1) The rod might give way; (2) the iron resistance might burn out; (3) the heating coil might fail. There was also a suggestion in one part of the paper that it might be advisable to change the resistance during the life of a burner, which made four things to be attended to during the life of the lamp. If the average life was only 400 hours, it seemed to him that the Nernst lamp would require such an amount of personal attention that the saving and cost would not be worth the trouble. The regulating effect of the iron resistance was remarkable, because at a certain part of the curve the volts could be greatly increased without any increase in current and by arranging the resistance so that this current was the normal working current of the lamp, the resistance was made of special value to the rod.

In reply to the discussion, Mr. Hulse said that the figures given for the glow lamp were such as to make the best possible case for it, and that whereas it absorbed considerably more than 3 watts per candle, the Nernst lamp only required for a life of 400 hours an average of 2·1 watts per candle. In the construction given for finding the most economical light, the total cost of replacing a burner, including trouble and fitting, was allowed for. Mr. Bates's suggestion as to the cause of hissing seemed very probable, but the fact remained that removing the protecting globe did not affect the hissing. As Mr. Lea had said, a glow lamp would run on perfectly steady pressure, and would burn for a very long time, but at the end of that time it would also be taking a large amount of power—probably 6 watts per candle-power, or even more. One of the three causes of failure cited, namely, the rod breaking, was, in reality, an advantage, since it prevented the lamp continuing to burn after the end of its economical life; the other two causes were unlikely to occur. The difference between 11d. and 1s. 3d. represented a reduction of 26 per cent., and this figure would probably be considerably increased in actual practice owing to the favourable figures taken for the glow lamp.

Dr. Morris, who was called upon by the chairman to make any further remarks, said that the merits of the Nernst lamp had hardly been appreciated in the discussion. For instance, Mr. Lea had criticised the lamp on the score of variation of voltage, shortness of life, and trouble of renewing. The volts on the burner could not be varied, and any fluctuation on the mains was absorbed by the iron resistance. With regard to shortness of life, the question arose, what did the public want? Did they want a certain amount of illumination with a certain number of watts, or were they content with putting in a lamp, and continuing to get some sort of light for a very long time irrespective of any other consideration? When emphasis was laid on the trouble of renewing the burner in the Nernst lamp, it was only fair to remember that the lamp was not made in small sizes like the ordinary glow lamp. He thought that it was the most suitable thing on the market for a large room or for halls of moderate size, and in criticising it one should compare it more with the arc than the glow lamp.

THE WOLVERHAMPTON EXHIBITION.

On Friday last a large gathering of journalists from London and the provinces visited Wolverhampton for a special inspection of the Art and Industrial Exhibition, prior to its formal opening by the Duke and Duchess of Connaught.

The originator of the Exhibition is Mr. Thomas Graham, who is chairman of the Executive Committee, and it is expected that much good will accrue to the town and surrounding neighbourhood beyond the expansion of its industry and the technical teaching of its young people.

But for us the main point is the machinery portion of the show, and to this we must confine ourselves, leaving Art to others.

The site of the Exhibition is the West Park, which is convenient in every way, and in itself both charming and picturesque; and compared with that in which the Glasgow Exhibition was held, is simply ideal, as it is one of the most carefully-tended and beautiful haunts of the people in the country. A large amount of adjoining land was generously placed at the disposal of the Committee by Lord Barnard, who thus, having also the co-operation of the municipal authority, found themselves in command of an area of some 32 acres. The main buildings cover more than 127,000 sq. ft., and about £100,000 has been expended on the entire project. The grounds have been laid out by expert gardeners, the designs being artistic and in perfect harmony with the surroundings, and altogether the buildings and grounds present a most delightful picture.

It would not be easy to find designs more striking and picturesque, both as to colour and outline, than those for which the architects, Messrs. Walker & Ramsay, of Glasgow, are responsible. They break new ground in Exhibition architecture. The Industrial Hall forms the north-east termination of a Crescent, which includes also the Canadian Pavilion and the Machinery Hall. It is of light and graceful design. Internally, the Hall is divided into three bays, with half bays additional at the front and back, the half bay in front forming an arcaded tea terrace, while that in the rear is absorbed in the Hall. The roof, which is largely glazed, is supported by semi-circular ribs, sufficiently lightly constructed as to impart a very airy and graceful effect. This Hall of Industry is of the dimensions of 377 ft. by 172 ft.

The Machinery Hall, measuring 350 ft. by 130 ft., is reached after a few steps have been taken from the one previously dealt with. In design the place is robust, but simple. The main front, which faces the south-west elevation of the Industrial Hall, is circular in outline, this form being determined by the contour of the roof which is constructed on the bow-string principle. Internally, the structure is divided into three bays, the centre being 60 ft. wide, and those at the side each 38 ft. wide. Here boilers of a new type will be used to generate the steam for the motor power necessary in the Exhibition, for lighting, and for driving the machinery. They will produce about 3,000 H.P., and consist of two water-tube boilers on the Dürr system, two on the Cahall vertical water-tube system, and a Babcock and Wilcox water-tube boiler. A capital collection of electric generating plant is exhibited, the machinery—in motion and stationary—having all the latest improvements. It is, in short, an instructive, interesting, and representative aggregation of machinery that claims the attention of the visitor. Large engines, dynamos, motors, electric hoists, weaving looms, lathes, ventilators, warming and lighting appliances, many machine tool and woodwork exhibits by firms of the first repute, are staged and will be shown in actual motion. The distribution of the various electric sources of supply will be on quite a novel system. A conspicuous and interesting object in the centre of this Hall is the switchboard, which Ferranti, Limited, have erected.

The Canadian Pavilion is also of the highest possible interest, and inside the visitor finds one of the best shows which the Dominion has yet sent out, everything appertaining to the natural resources of this favoured land being prominently to the fore.

A fine Concert Hall will doubtless be a great centre of attraction, for no less than £10,000 is to be spent in bringing before the visitors the best compositions in the illimitable field of the Divine Art, executed by capable orchestras and eminent vocal and instrumental soloists.

In Mr. Kiralfy's wonderful World's Fair we find a new and novel spiral toboggan, a journey on which is thrilling to a degree. The Canadian water chute is the largest yet erected in this country, and what with the Fairy River, the Hall of Laughter, motor launches and white swan-boats, the Art Section, restaurants, &c., Wolverhampton has provided of the best for the lighter amusements of the people.

In providing for the motive power required for generating electric energy for lighting the buildings and grounds of the Exhibition, and also for driving various descriptions of machinery shown in motion by exhibitors, eminent firms of boiler makers, engine builders, dynamo constructors, and others were invited to lend plant (upon certain terms with regard to their installation and working) to the Executive for the period of the Exhibition. Most liberal and hearty responses were received, and although the time available for the manufacture of the heavy machinery required was very limited, yet the Committee were able to select from amongst the various plants offered a display of power generating plant embodying the very latest practice in its several component parts that have been erected in the Machinery Hall; and to those firms and gentlemen enumerated in the following "complimentary" list the Executive tender their acknowledgment of the services rendered.

It was determined not to follow the usual practice in former Exhibitions of erecting long lines of counter-shafting from which exhibitors could obtain power for showing their machinery in operation, or to light the several sections of the Exhibition by means of a plant set apart for each particular section, but to establish a thoroughly up-to-date electricity station, such as might be erected in a thriving moderate-sized town wishing to take advantage of the latest developments in electrical science. With this end in view, a network of underground cables has been laid down, radiating from one central switchboard, lent by Messrs. Ferranti, Limited, to convenient distributing centres, and from these centres the energy is taken both for lighting and motive power wherever required.

The three-wire system, so far as the main feeders are concerned, has been adopted throughout with a continuous current of 500 volts pressure between the outer cables, as being the most convenient for the purpose. The British Insulated Wire Company's triple-concentric cable was selected for the purpose, and installed by that company. The wire for the arc light circuits inside the buildings has been supplied by Messrs. Isidor Frankenburg, Limited, and that for the circuits in the grounds of the Exhibition, which are run overhead and are composed of a single strand of bare aluminium wire, has been lent by the British Aluminium Company. Tenders were asked for from a number of firms for the wiring for the lighting circuits, and the work was divided between two of them.

It was left to exhibitors requiring motive power to provide their own motors and connect them to the distributing centres, in accordance with regulations drawn up by the committee for their guidance; motors of 5 H.P. and under working at 250 volts pressure, and motors of upwards of that power at 500 volts, the current, in every case, being supplied free of cost to exhibitors.

In the Main Exhibition Halls and the parts of the Park more distant from the power station a system of arc lighting has been adopted, the lamps selected being those of the Brockie-Pell Arc Lamp Company, run in parallels of ten or five as required. For the Concert Hall, restaurants, band-stands, offices, &c., incandescent lamps are used of 250 volts, the firms selected to supply these being the Edison-Swan United Electric Light Company and the Hiram Maxim Lamp Company.

A considerable scheme of illuminating the exterior of the Exhibition buildings by outlining the entire façade of each with lines of glow lamps has also been carried out, about 20,000 lamps of 16-C.P. each being used; these lamps are of 100 volts, run in series of five, and grouped in circuits requiring about 30 amperes.

In a preliminary notice such as this, we must perforce content ourselves by mentioning the more prominent

exhibitors, leaving a detailed account of their exhibits for a more favourable opportunity, when everything is in full working order.

Complimentary List.

Messrs. Babcock & Wilcox, Limited, Oriel House, 30, Farringdon Street, London, E.C., show a Babcock & Wilcox patent water-tube boiler, with mechanical stoker, purifier fitted to drum, wrought-iron chimney, &c.

Edwin Danks & Co. (Oldbury), Limited, Oldbury Boiler Works, near Birmingham. Two "Cahall" vertical water-tube boilers, 600 I.H P. each.

John Thompson, Ettingshall Boiler Works, Wolverhampton. Two 500-H.P. water-tube boilers, Dürr patent.

Lloyd & Lloyd, Limited, Albion Tube Works, Nile Street, Birmingham. Main steam-wrought steel-lapwelded pipes; also subsidiary steam pipes, with flanges and branches complete.

Joseph Evans & Sons, Culwell Works, Wolverhampton. Two compound "Cornish" horizontal double-acting outside-packed-ram boiler feed pumps. One compound vertical "Beam" feed pump, with single-acting outside-packed rams.

Holden & Brooke, Limited, Sirius Works, West Gorton, Manchester. Holden & Brooke's patent high-pressure steam traps.

Metallic Jointing and Packing Company, Ardrossan. Corrugated metallic packing for joints, fitted throughout the main and auxiliary pipes of the Exhibition.

Empire Engineering Company, Failsworth, Manchester. Three 3-in. cast-iron escape valves, with gun-metal valve and seating. Suitable for cylinder covers. Great discharging capacity.

Joseph Wright & Co., Neptune Engineering Works, Tipton. Berryman patent water heaters:—(1) Standard Berryman, with syphon bottom; (2) "Tipton" pattern; (3) "Simplex" pattern. Each heater is adapted for a working pressure of 180 lbs. per sq. in., and fitted with ∩-shaped Berryman Universal expanding brass tubes, of sufficient surface to enable each heater to raise 2,200 gallons of cold water to a temperature of 200° F. and upwards per hour by passing the exhaust steam under usual conditions.

Glenfield & Kennedy, Limited, Kilmarnock, Ayrshire, Scotland. High-pressure steam stop valves, expansion joints for steam pipes, and sluice valves for exhaust steam fitted throughout the power station of the Exhibition.

Electric Construction Company, Limited, Wolverhampton. 500-KW. electric power generator, eight-polar, slot-wound, direct-coupled type, voltage, 450—500; revolutions per minute, 270; 250-KW. electric power generator, four-polar, slot-wound, direct-coupled type, voltage 500—550 for traction, 450—500 for lighting; revolutions per minute, 380. E.C.C. balancer, patent V. R. type, for automatically regulating the balance of E.M.F. on a three-wire system, capacity 200 amperes, 230—250 volts per side.

Belliss & Morcom, Limited, Ledsam Street Works, Birmingham. "Belliss" patent self-lubricating triple-expansion three-crank engine, 800 B H.P. standard, driving Electric Construction Company dynamo for power, traction, or lighting. "Belliss" patent self-lubricating triple-expansion three-crank engine, 400 B.H.P. standard, driving Electric Construction Company dynamo for power, traction, or lighting.

Robey & Co., Limited, Globe Works, Lincoln. Coupled compound fixed engine, mammoth type bed, fitted with Richardson's governor and cut-off gear, combined with Mavor & Coulson's 400-KW. dynamo. 11-in. stroke vertical marine type high-speed engine, fitted with Richardson's patent governor and link-expansion gear, driving Scott & Mountain's 75-KW. dynamo. 6-in. stroke enclosed vertical high-speed engine, with Richardson & Wansbrough's patent system of forced lubrication, driving Scott and Mountain's 65-KW. dynamo.

Browett, Lindley & Co., Limited, Sandon Works, Patricroft, Manchester. Three-crank, triple-expansion steam engine, having 13½-in. H.P. cylinder, 19½-in. intermediate cylinder, and 28-in L.P. cylinder, 10-in. stroke, running at a speed of 320 revolutions per minute; coupled to a dynamo made by Messrs. Dick, Kerr & Co., Limited.

Dick, Kerr & Co., Limited, 110, Cannon Street, London, E.C. The generator is compound-wound, developing 325 KW. at 550 volts, and allows of considerable overloads without brush adjustment.

W. Sisson & Co., engineers, Gloucester. Compound double-crank self-lubricating automatic engine, cylinders 9½ in. and 15 in., stroke 9 in., 130-B.H.P., continuously at 400 revolutions; overload up to 155 B H.P.; in conjunction with dynamo by the Lancashire Dynamo and Motor Company, Limited.

Lancashire Dynamo and Motor Company, Limited, Trafford Park, Manchester. 90-KW. six-pole dynamo for direct coupling, developing 360 amperes, 250 volts, at 400 revolutions per minute; suitable for lighting and power circuits.

D. Bruce Peebles & Co., Tay Works, Edinburgh. Peebles-Willans 500-KW. at 500 volts, electric lighting and traction generating set.

Willans & Robinson, Limited, Victoria Works, Rugby. Willans central valve triple-expansion engine, 825 I H.P., 270 revolutions per minute, suitable for electric lighting, electric traction, electrie transmission of power; in conjunction with dynamo by Messrs. D. Bruce Peebles & Co.

C. C. Wakefield & Co., 27, Cannon Street, London, E.C. High-class lubricants as used on the motive power plant in the Exhibition. Cylinder, engine, and dynamo oils.

Electric Lamps, Cables, &c.

Brockie-Pell Arc Lamp, Limited, offices and works, 60, Worship Street, London, E.C. The arc lamps used for lighting the Exhibition buildings and grounds are the patent lamps manufactured by this company.

Edison and Swan United Electric Light Company, Limited, 36, Queen Street, Cheapside, London, E.C. The whole of the electric incandescent lamps used in the lighting and decoration of Industrial and Machinery Halls, Canadian Pavilion, and the restaurants are of the Royal Ediswan type.

Hiram Maxim Lamp Company, Limited, 17, Shaftesbury Avenue, London, W. The incandescent electric lamps used for lighting or for the decorative illumination of the Concert Hall and Central Bandstand are the "Rex" lamp manufactured by this company.

The British Insulated Wire Company, Limited, Prescot, Lancashire. Electric lighting and power main cables used throughout the Exhibition are supplied by the above company, consisting of triple-concentric feeders, concentric distributors, three-core pilot wire, single machine feeders, junction boxes, fuse boxes, and cable end connections.

Isidor Frankenburg, Limited, Rubber and Cable Works, Greengate, Salford, Manchester. Vulcanised rubber, taped and braided cable used in connection with the arc lighting of the Exhibition Buildings, 12,000 yards.

William McGeoch & Co., Limited, Warwick Works, Birmingham, Glasgow, and London. Manufacturers of all the electric light fittings and brackets in Concert Hall and first-class dining room in No. 1 Restaurant of Exhibition.

Switchboard.

Ferranti, Limited, Hollinwood, Lancashire. The switchboard controlling the light and power of the Exhibition is an example of this type. This gear is used for 500 volts three-wire system. Eight feeder panels are on the extreme right of the switchboard, each three-wire feeder panel consisting of two ammeters, two single-pole switches, and two sets of fuses. Two feeder voltmeters are mounted on the top slate and coupled up to the voltmeter switches on the regulating table. The earth and mid-wire ammeters are mounted to the left of the feeders. The switch gear for the balancer is mounted to the left again between feeders and dynamo panels. The balancer starting switch may be seen under the regulating table in front of the board. We next come to the eight generator panels, which can be distinguished by the two different types of switches used; the positive side being arranged with an automatic attachment, the negative having fuses. Each of these generator panels contains an ammeter and a quick-break switch which is operated by an automatic device (designed to open the machine circuit on reversal of current) fixed in the recess under the switch, a quick-break knife switch, and a fuse with duplicate contacts. Edgewise voltmeters are mounted on the top slate for paralleling and bus-bar volts. The regulating table in the front contains a switch in the field circuit of the dynamos and a hand-wheel for regulating the pressure across the terminals of the machine, the resistances being of the Ferranti open type, mounted underneath the switchboard platform.

Barr & Stroud, 250, Byres Road, Glasgow. Electrically-driven clocks in the Industrial and Machinery Halls. These clocks are suitable for town, workshop, or railway station use.

National Telephone Company, Limited, Telephone House, Victoria Embankment, London, E.C. The Telephone Exchange and main switchboard, also the telephone system fitted throughout the Exhibition.

In the Industrial Hall.

J. Halden & Co., 8, Albert Square, Manchester. Arc lamp photo copying frame, engineer's photo copying processes and papers, drawings instruments, surveyor's instruments, mining surveyor's instruments, drawing office materials and appliances.

Earle, Bourne & Co., Limited, Heath Street South, Birmingham. Tubes, all descriptions brass and copper, plain, shaped, ornamental, parallel and taper. Cased tubes, steel tubes, close joint and brazed. Rolled metals.

Joseph Sankey & Sons, Albert Street Works, Bilston. Hardware. Art metal work. Iron and steel stampings.

J. H. Butler, Bell Works, Bell Street, Wolverhampton. Electric light fittings, patent electric busts.

Singer Manufacturing Company, 91 and 93, Station Street, Birmingham. Electric motors for driving sewing machines.

New Brotherton Tube Company, Limited, Commercial Road, Wolverhampton. Tubes.—Gas, steam, and water tubes and fittings. Weldless steel cycle tubes and handle bars. Enamelled steel conduit tubes and fittings for enclosing electric wires.

In the Machinery Hall.

E. J. and J. Pearson, Limited, Firebrick Works, Stourbridge. Patent angular-contact boiler seating blocks, flue covers, and covering slabs. Full size section of boiler setting, showing method of using blocks. Fireclay grate-backs.

Crossley Brothers, Limited, Openshaw, Manchester. Gas engines:—"H" type 1 B.H.P.; "M" type 7 B.H.P.; "VE" type, combined with dynamo, output of 150 amperes, at 200 volts. Oil engine:—"OO" type 7 B.H.P.

National Gas Engine Company, Limited, Wellington Works, Ashton-under-Lyme. One "Za" "ME" and "Ka" type gas engines.

Samuel Platt, King's Hill Foundry, Wednesbury. Shafting and fittings, rope and band pulleys, drop hammers, screwing and tapping machines, bolt and nut machinery.

Joseph Wright & Co., Neptune Engine and Chain Works, Tipton. Berryman's patent feed-water heaters, Excelsior heater, filter and oil separator, exhaust steam filter, greasy water filter, safety detaching hook (working model) crane and sling chains, hooks, &c.

Mavor & Coulson, Limited, 47, King Street, Mile End, Glasgow.

Electric bar coal-cutting machine (Hurd's patent), with universal movement for cutting on the pavement or at the roof and on the right or left hand side.

Cowlishaw, Walker & Co., Limited, Etruria, Stoke-on-Trent. Electrical coal-cutting machine (patent) of the "Bar" type.

Lloyd & Lloyd, Limited, Albion Tube Works, Birmingham, and Coombs Wood Works, Halesowen. Wrought-iron and steel tubes for high pressure steam, water, air, heating, refrigerating, well-driving and casing. Examples, coils and various joints and fittings.

Arthur Lowcock, Limited, Coleham Foundry, Shrewsbury. "Lowcock's" improved patent fuel economiser, heating feed-water to steam boilers; specially constructed for single boilers and small spaces. Model of standard size economiser.

Smoke Preventer Company, Limited, 10, Richmond Terrace, Blackburn, and 75, Queen Victoria Street, London, E.C. Working model of the E.S.E. patent mechanical stoker.

Stirling Boiler Company, Limited, 2, St. Andrew Square, Edinburgh. Models showing two views of boiler. A sectional view shows the construction of tubes and drums.

Cameron, Hastie & Co., Limited, Sandwell Road, Handsworth, Birmingham. Removable silicate sheets for boiler and pipe covering.

Hunt & Mitton, Oozells Street North, Birmingham. Engine and boiler mountings, including pressure gauges, water gauges, check valves, high and low safety valves, feed-water filters, lubricators, sight feed lubricators in operation, steam cylinder piston lubricators, Bourdon's oil well with multiple distributors for steam cylinders, sight feed oil syphons, crank-pin oilers, pressure indicators.

H. & T. Danks, Limited, Crown Boiler Works, Netherton, near Dudley. High-pressure "Economic" boiler. Section of flue for "Lancashire," "Cornish," or "Economic" type boilers. Danks's patent expansion ring for high-pressure boilers, &c.

Electric Construction Company, Limited, Wolverhampton. One three-phase 100-KW. rotary converter; one 200-ampere variable-ratio balancer; three alternating-current transformers, one of 60-KW. capacity; one Hayward-Tyler pump, driven by electric motor; electrical portable drill; electric capstan and gear; 15-H.P. three-phase motor, a 7½ ditto, and a 2½ ditto, with reduction gear; 5, 12, and 25-H.P. Bushbury motors, with reduction gear; 5, 6, and 8-H.P. Bushbury motors; two "Stafford" four-pole motors; one "Stafford" six-pole motor; one standard E.C.C. two-pole dynamo and one standard E.C.C. No. 7 two-pole motor, fitted with reduction gear; two crane controllers and one capstan controller; one "Highfield" booster; sundry switchgear, &c.

Heenan & Froude, Aston Ironworks, Birmingham. Electric hauling engines, electric capstans, steam pumps, refuse destructors, dynamometers, spherical engines.

D. Bruce Peebles & Co., Tay Works, Edinburgh. 500-KW. Peebles-Willans lighting and traction generating set. 300-H.P. continuous-current dynamo, coupled to three-phase sub-station motor, generators and rotaries, mining motors, continuous-current and three-phase geared motors, electrically-driven hauling gears, winches, pumps, &c. Barclay three-throw pump, driven by three-phase motor.

Bumstead & Chandler, Cannock Chase Engine Works, Hednesford. High-speed engine and fan for mechanical draught and small Chandler patent engine coupled to dynamo for electric lighting.

Isidor Frankenburg, Limited, Rubber and Cable Works, Greengate, Salford, Manchester. Drums of vulcanised rubber, armoured lead-sheathed wires and cables. Various sections and samples of cables in different classes.

Wallach Bros., engineers and mill finishers, 57, Gracechurch Street, London, E.C., and at 108A, Hope Street, Glasgow. Gauge guards, belt lifters, tube scrapers, drilling machines, asbestos, rubber, beltings, electrical testing, measuring apparatus, respirators, face, eye, and head guards.

B. J. Hall & Co., 39, Victoria Street, London, S.W. City Branch: 37, Walbrook, London, E.C. Cylindrical electrical copier (Hall's patent) for blue and line prints from drawings and tracings, developing baths, photographic papers, prints, drawing office materials and instruments.

Stern Bros., 57, Gracechurch Street, London, E.C., and at 108, Hope Street, Glasgow. Oils, greases, petroleum jellies, solid sternolines, asbestos compound mica cream, belting bricks, soluble oil glandoline, universoline, white and half-white and yellow bloomless oils.

Charles Carr, Limited, Woodland Works, Grove Lane, Smethwick. Steam fittings, bells of all kinds, castings of all kinds, Carr's patent crucible furnace, metals and alloys, stair treads, ignition tubes, brazing solder.

Crompton & Co., Limited, Salisbury House, London Wall, London, E.C., have a small exhibit of instruments, motors, &c. They also show in connection with Messrs. Whitehead, Morris and Co., eight electrical motors driving printing machinery.

R. Becker & Co., 50 and 52, Rivington Street, Curtain Road, London, E.C. Kiessling's woodworking machinery, electric motors, drilling machines.

J. Sagar & Co., Limited, Canal Works, Halifax. "Premier" hand and roller feed surface planing, moulding and thicknessing machine. Heavy double-geared roller-feed planing and thicknessing machine, to plane up to 24 in. wide.

Thomas Robinson & Son, Limited, Railway Works, Rochdale. Wood working machinery.

Alfred Herbert, Limited, machine tool makers, Coventry. Automatic and semi-automatic labour-saving machine tools in motion. Turret lathes, automatic screw machines, milling machines, cutter grinding machines, sensitive drilling machines, small tools.

Ferranti, Limited, Hollinwood, Lancashire. Switchgear controlling the Exhibition generators and power and lighting scheme, also C.C. meters, transformers, fuses, resistances, rectifier, &c.

J. Rhodes & Sons, Limited, Grove Iron Works, Wakefield, Yorkshire. Sheet metal working machinery for stamping tin and sheet-ironware.

Holt & Willetts, Lion Works and Victoria Foundry, Cradley Heath. Electric and power lifts in motion, overhead traveller, pulley blocks, jacks, crabs, and punching bears.

Walter Somers & Co., Limited, Haywood Forge, Halesowen, near Birmingham. Steel and iron forgings of every description up to 30 tons. Connecting and piston rods, crankshafts.

Tangyes, Limited, Cornwall Works, Birmingham. Tangyes' gas engine, "Otto" principle. Tangyes' patents. 100 effective working brake horse-power, fitted with self-starter.

Smith & Coventry, Limited, Gresley Iron Works, Salford, Manchester. Machine for milling, bevel wheel-cutting (automatic), radial drilling, planing, turning and boring mills, flat turret and improved screw-cutting lathes.

Sandycroft Foundry Company, Limited, near Chester.—Air compressor with "Daws" patent valves, driven by slow speed semi-enclosed four-pole "Sandycroft" electric motor and driving 2¼ in. "Little Hercules" rock drill. Electrically driven model of 10 head "High Bank" gold stamp mill—falling weight 1,500 lbs. Miscellaneous stamp parts.

Bever, Dorling & Co., Limited, Dewsbury Foundry, Dewsbury.—One combined steam dynamo. One three-throw vertical plunger pump suitable for high pressure boiler feed up to 200 lbs. to the sq. in. Automatic slow starting motor. One main switchboard. One Bever's patent duplex pumping engine, 6-in. cylinders, 4-in. pumps suitable for general pump purposes, boiler pump, fire pump.

Phœnix Dynamo Manufacturing Company, Joseph Street Works, Bradford, Yorks.—40-KW. steam dynamo, 800 revs. (Bever, Dorling and Co.'s engines. 10-B.H.P. standard semi-enclosed motor, coupled to pump.

D. Selby, Bigge & Co., electric power engineers, Newcastle-on-Tyne. Branches: London, Glasgow and Swansea.—Compound high pressure generating set, rated at 200 E.H.P. capable of 25 per cent. overload. Main switchboard. Electric winch. Various motors. Model of punching and shearing machine electrically driven.

Anderston Foundry Company, Limited, 100, Cheapside Street, Glasgow.—Quick, rotative, self-lubricating, enclosed engine with generator.

Mirrlees Watson Company, Limited, 54, Scotland Street, Glasgow.—30-H.P. patent self-lubricating single-acting compound high speed engine with dynamo. 60-H.P. engines, similar to above, without dynamo.

W. H. Willcox & Co., Limited, 23, 34 and 36, Southwark Street, London, S.E. Cylinder and lubricating oils, engine packings, valves and boiler mountings, Willcox-Sim rotary pumps, Penberthy injectors, X-L. ejectors, patent wire bound hose, leather belting.

Hiram Maxim Lamp Company, Limited, 17, Shaftesbury Avenue, London, W. "Rex" lamp (king of electric lamps), also the spiralette (crystal device for increasing the light of lamps).

Hordern & Mason, Vulcan Works, Vesey Street, Birmingham. Machinery for sheet-metal trades

John Baird, 99, Milton Street, Port Dundas, Glasgow. Glass for table, lamp, gas, electric and incandescent light globes.

James Stott & Co., 41, Paradise Street, Birmingham. Fans for ventilating, removing dust, drying, &c., driven by means of belt, electric current, or water.

Edison and Swan United Electric Light Company, Limited. 36—37, Queen Street, Cheapside, London, E.C. Electric lamps, of all descriptions; electric motors and machinery; electric fittings and accessories.

Taylor & Challen, Limited, Derwent Foundry, Constitution Hill, Birmingham. Power presses and dies, drawing, stamping, and cutting seamless articles from sheets. Notching and punching presses for armature discs.

Frictionless Engine Packing Company, Limited, Hendham Vale Works, Harpurhey, Manchester. Karmal steam and hydraulic packing; patent metallic packing; patent semi metallic packing; patent "Roko-edge" belting, red and black; special "Roko" belt paste.

Thompson Bros., Bradley Boiler Works, Bilston. Solid welded galvanising baths, chemical vats and tanks.

Mica Boiler Covering Company, Limited, Cornwall Buildings, 35, Queen Victoria Street, London, E.C. Removable coverings in flexible and moulded form, for boilers, steam pipes, hot and cold water pipes, and refrigerating plants.

EXHIBITS IN GROUNDS.

Galloways, Limited, Knott Mill Iron Works, Manchester. One 300-H.P. Galloway high-speed engine, enclosed type, with forced lubrication and Lindley's patent throttling governor, coupled to Mather & Platt multipolar generator.

John Thompson, Ettingshall Boiler Works, Wolverhampton. Machine made Lancashire boiler, 30 ft. long, 8 ft. diameter.

Danks & Co. (Oldbury), Limited, Oldbury Boiler Works, near Birmingham. "Cahall" vertical water-tube boiler, 600 I.H.P. Multi-tubular dry-back marine type boiler, 14 ft. long × 11 ft. 6 in. diameter.

E. Green & Son, Limited, 2, Exchange Street, Manchester, and Works, Wakefield, Yorks. Green's improved patent fuel economiser for steam boilers, utilises waste flue gases to heat boiler feed water.

C. Wuest & Co., Seebach-Zurich, Switzerland. Electrical

machinery. Transformation of continuous current into three-phase alternating, and use of same in driving machines, through motors, with several speeds.

International Pneumatic Tool Company, Limited, Palace Chambers, 9, Bridge Street, Westminster, London, S.W. "Little Giant" pneumatic tools and compressed air appliances generally (in operation).

Of the executive staff we may mention Mr. H. A. Hedley, technical adviser, who was so much in evidence over the Glasgow Exhibition; Mr. J. H. Cundall, general manager and engineer, who, from our knowledge of him of old, we feel sure will leave no stone unturned in his department to ensure the success of the Exhibition from both an engineering and commercial standpoint; Mr. Stephen Watkins, secretary, who, with Mr. Pearson, one of the honorary auditors, courteously showed us many little attentions; Mr. Percival C. Cannon, assistant engineer; and Mr. A. C. Freeman, assistant electrical engineer.

The President is the Right Hon. the Earl of Dartmouth; and there are no less than 66 vice-presidents, several being leaders of engineering and science.

The Executive Council is very numerous and representative, and amongst the London Honorary Committee we notice the names of Sir Frederick Abel, Lord Alverstone, Sir Daniel Cooper, Prof. Dewar, James Dredge, Sir Douglas Fox, Sir Henry Mance, James Paxman, Sir W. H. Preece, J. W. Swan, and other prominent personages. The hon. secretaries to the London Committee are W. J. Soulsby, Esq., C.B., and G. Gaskell Exton, Esq., M.I.M.E.

If our first impressions are not misleading, we shall expect later on to learn that the Wolverhampton Exhibition has turned out in its smaller sphere, as great a success, in all respects, as did that of Glasgow, which is saying a good deal, and if good wishes can help on the movement, those of the ELECTRICAL REVIEW are tendered with the heartiest cordiality to the promoters and all concerned in the welfare of the progressive Staffordshire town.

LONDON'S RAPID TRANSIT SCHEMES.

[COMMUNICATED.]

IN his paper on "London's Tubes, Trams, and Trains, 1902," read before the Society of Arts some weeks ago, Mr. Clifton Robinson has, with great ability, presented a most extensive epitome of the needs of London for rapid transit, and the attempts which have, up to date, been made to cope with these requirements.

It is refreshing to observe that Mr. Clifton Robinson considered it needless to dwell upon the rapid development of the uses of electricity; electrical men are easily bored by that sort of thing.

The first part of the paper shows conclusively that electric traction has advanced with great rapidity even in this slow old country. Perhaps it is well that there is some inertia in the British constitution, for this will prevent the electric traction industry from dying suddenly, and so there will not be a glut of unemployed tramway engineers in our institutions for poor relief, when some master brain evolves a superior system.

There is little to be said upon Mr. Robinson's remarks on the Tramways Act of 1870, except in concurrence therewith. This crying evil makes the respective gorges of all good tramway men to rise when they think of its heinous purchase clause, which causes the fruits of years of arduous labour to be collected by those who were bitter foes to the promotion of the tramway scheme.

The author of the paper has expressed a strongly adverse criticism of the action of the Metropolitan Railway Company in determining upon the construction of a station separate from that of the District Company. Without discussing the wisdom of the engineers as evinced by the selection of sites and plant, it will appear to most people that there is not so much advantage in centralisation as would justify Mr. Robinson in referring to it as "an essential element to economy and efficiency." The problems of distribution are often more effectually met when two stations are decided upon; furthermore, the performances of stations, while showing a sharp grade of reduction in cost as the capacity increases from small to medium sizes, do not exhibit this rapid increase in economy when large capacity stations are considered. The cost of power does not become much lessened when the capacity of the station exceeds 10,000 KW., and, after all, power is the cheapest thing in electric traction.

When Mr. Robinson refers to the glory of the London United Tramway Company's system, it causes one to envy the management of the company, which has traffic enough, and more than enough, in its district, to pay for the provision of that palatial design which contributes so much to the excellence of the services performed to the public.

The "shallow tunnel" will certainly not be vetoed on account of the outside seat difficulty. In time to come the British public will lose its love for the top seat, and anyhow, the idea is not so much to take the air as to get to business and away from it as quickly as possible. A tramway company in the Midlands worked one route with single-decked cars for some time, and when enough double-decked cars were available, put them on this route in place of the small cars. The travelling public were at once loud in their denunciation of the top-deck cars, and almost prayed for the restitution of their dear little single-deckers.

Tramway men will at least agree with Mr. Robinson when he says that "this talk of tramways not being taxed is nonsense pure and simple." That the directorate of a railway company should refer to tramway competition as "unfair" is unfair in itself, because such authority would lend weight to the expression when repeated by the opposers of any scheme.

In answer to the query, "In what form shall the power be applied on surface tramways?" Mr. Robinson says:—"To this I still unhesitatingly answer on behalf of the overhead trolley." While not losing sight of the advantages of the trolley system, it is well to consider the conduit as something which has quite a lot to be said in its favour. The surface contact system hardly merits consideration, and the writer is of opinion that in 20 years' time this peculiar cross-breed will be derided as a mechanical and electrical abortion. Reverting to the subject of the conduit, it is safe to say on its behalf that from mechanical considerations the system is superior to the overhead trolley, and that the course of experience will make it practically perfect. Of course it is not a suitable system for any but densely crowded city streets, where the traffic will pay for the outlay, and in all other places the trolley is good enough for tramways.

No one who has read Mr. Robinson's paper would fail to be struck with his evident appreciation of the fact that the great needs of the London public in rapid transit will make it good for the interests which may control the organisation which is to meet those requirements.

ELECTRO-MAGNETIC OSCILLATIONS.

BY RANKIN KENNEDY.

II.

IN further elucidation of the manner in which oscillations are propagated over the surface of a large insulated globe from one point to another, according to the theory that it is the globe's electrical condition that is disturbed, and the oscillations are confined to a superficial charge, the fact that a globe even of the dimensions of the earth could be charged by a not unusual quantity of electricity is of importance; the amount is no greater than that required to charge an Atlantic submarine cable.

Now, supposing for a time we had a means of charging a globe, and the field of force produced polarised vertically, being a sphere, these lines would be radial all over the globe, and so long as no change occurred in the charge, no indications of its presence could be easily detected. And suppose again we had a means of detecting an electric field, akin to the magnetic needle, which detects a magnetic field and indicates its direction, this indicator would stand perpendicular to the surface. A detector of this kind for exploring electric fields can be best made of a dry pile. An extremely light dry pile delicately suspended when placed in an electric field at once aligns itself parallel to the lines of electric force, its

positive end pointing to the negative pole and its negative end towards the positive pole, acting as a detector and indicator.

Placed in a field between neutral bodies it, like the magnetic needle, is indifferent or attracted in directions drawn by its own field; but suppose this electric needle suspended anywhere over the electrified globe, and the globe to be negatively electrified, the pile would be compelled to point its positive end downwards, and if the globe's charge were reversed, the pile would be simultaneously reversed, making a half-turn on its axis of suspension. And so by reversing the charge on the globe, we could waggle the pile from side to side, no matter on what spot the pile happened to be situated on the globe, and these right and left swings could form ordinary needle instrument signals; therein we have the key to wireless telegraphy round a globe. This is represented diagrammatically in fig. 2. At A is the supposed electric charge reverser, by means of which the globe can be charged positive or negative at will; at B we have the suspended pile, which will turn its one or other end downwards according to the sign of the charge on the globe. So far then we could have wireless telegraphy all over a globe of any size, provided we could charge it electrically and reverse its charge at will. And it is quite practicable to work a model telegraph of this

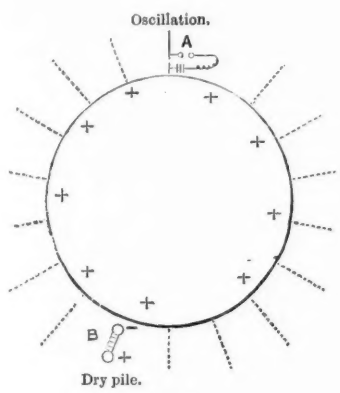
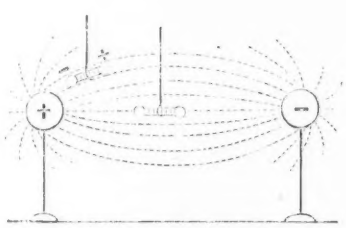


FIG. 2.



Dry ile electric field explorer.

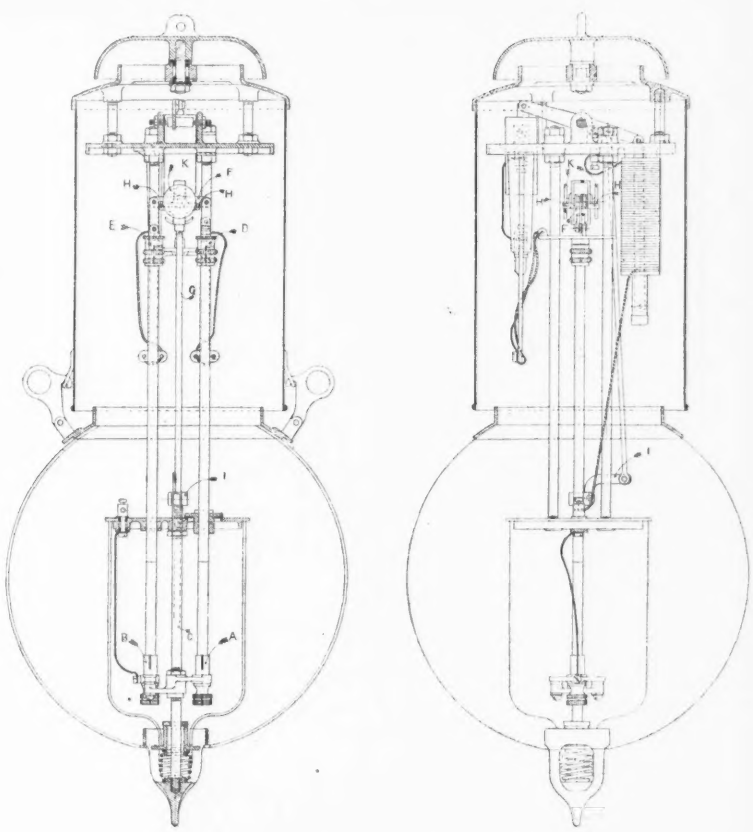
FIG. 3.

ELECTRO-MAGNETIC OSCILLATIONS.

The next hypothesis clears away the difficulty of the opposite charges required to work as in the foregoing experiment, for the opposite charges may be separated on the globe itself.

The oscillations may be set up on a ball without actual connection of the oscillator with the ball. This system has been employed on the continent; the lower end of the oscillator terminates in a coil or plate which, although not directly connected to earth, is connected inductively thereto. Fig. 3 shows the application of the dry pile for the purpose of exploring electric fields stationary or oscillating slowly.

Clerk Maxwell assumed that electricity moved off from points at a high potential as a charged mass of air in the form of an invisible electric cloud, and showed by experiment that electrified air could exist in close proximity to the earth or conductors without discharge; and we must therefore not only consider the part played by the earth, but also that played by the atmosphere in any scientific explanation of wireless telegraphy other than that worked on the straight line theory. To the man in the street it sounds convincing to tell him that the messages are conveyed by oscillations or "waves" in the ether travelling like light, but it is not convincing to the science student who wants to know how "they get round the corner."



A NEW TYPE OF CONTINUOUS CURRENT ARC LAMP.

description, without wires over a large globe, with slow oscillations of charge over its surface. Applied to the earth as a globe we must, of course, explain where the opposite charge exists on the other side of the dielectric; that is the difficulty at first presented, but confining our consideration to the artificial globe at present, which being in a room or near the earth, there is no difficulty about the existence of the opposite charge. All that the experiment is intended to convey is that signalling between two points on a ball is perfectly feasible on ordinary electrostatic theories.

A Branly detector fixed to the globe would also respond to the reversals of charge, for a current would pass at each reversal. Thus, according to this theory, we confine our chief examination to the earth instead of neglecting the earth and going into the clouds.

A NEW TYPE OF CONTINUOUS CURRENT ARC LAMP.

By FRANK LEWIS.

CONTINUOUS current open arc lamps, in spite of the many denials by interested manufacturers, do, in fact, give more light for a given consumption of energy than enclosed lamps. On the other hand, for many purposes, the cost of carbons and trimming, and the trouble entailed therewith, make it preferable to employ the long-burning lamp. Another point in favour of the enclosed lamp of great value for street

lighting, is that only those rays of light are of importance which reach midway between two arc lamps, and these particular rays are not much less with the enclosed than with the open type. For street illumination with any type of lamp there is always quite enough light in the immediate neighbourhood of the posts, and it is the distribution of light to greater distances that presents the difficulty. A disadvantage with the open arc is that on modern supply networks of 200 to 250 volts pressure, five open arcs must be run in series, and consequently a breakdown may involve the extinguishing of the whole circuit. Besides, each lamp requires the complication of a cut-out and a substitutional resistance.

When Bradford doubled its pressure to 230 volts, Mr. Gibbings, the engineer at that time, suggested the use of two small open arcs running in one lamp. Two such lamps were then run in series on the 230 volts. This to some extent minimised the objection to doubling the pressure with arc lighting, and no doubt if enclosed lamps had then been as perfect as they are now, Mr. Gibbings would have run the two arcs in one globe, which would have enabled a a single lamp to be run singly on the higher pressure.

The writer has designed an arc lamp on these lines, but has obviated the complication of having a separate mechanism to control each of the arcs. The arrangement is such that when the current is switched off each pair of carbons is brought into contact. The mechanism is so designed that its first action after switching on is to lock the upper carbons together in the position they take up when touching the lower carbons, so that they are rigidly clamped together. The next action consists of their being drawn apart, thus striking both the arcs. When the current is switched off the action is reversed, the carbons being unlocked from one another so that both pairs touch. The perfect action of the lamp presupposes that the carbons consume at the same rate, and it has been found in practice that if modern carbons are employed this assumption is correct. After 40 or 50 hours' run the variation in consumption is found by experiments to be $\frac{1}{64}$ in., and it is seldom, if ever, that any lamp is required to be run for a greater time than 16 hours continuously. A cross-section of the lamp is shown in fig. 1.

The lower carbons are fixed, one of them marked A being connected to the body of the lamp, and the other marked B is insulated. A central tube to which the two lower carbons are fixed is shown marked C. The two carbons are surrounded by an enclosing globe. The upper carbons are fixed respectively into two spring carbon holders, one marked D being insulated from, and the one marked E being connected to, the body of the lamp. The current is led through D, thence from the arc to the lower carbon A, through the body of the lamp to the upper carbon, E, through the arc and the insulated carbon, B, to the other terminal. Each carbon holder is linked to a lever, F, to the spindle of which two discs, K, are rigidly fixed. This spindle is loosely pivotted in a cast metal framework to which a rod, G, is fixed which slides in the tube, C. The bearings of the spindle are made very large to allow of a certain amount of movement vertically apart from the lever. On the framework of the casting four stops marked H are provided, turned concentric with the pivotting hole, the stops being cut about $\frac{1}{32}$ in. below the horizontal diameter. A clutch, I, of similar type to that employed on the carbons of the ordinary enclosed lamp is actuated by a solenoid through which the current passes to the arcs, and by the movement of the rod, G, controls the lamp.

The action is as follows :—When the lamp is switched on the clutch, I, is pulled up by the core of the solenoid, thus lifting the cast framework by the rod, G, and pushing up the stops, H. The discs are thereby locked, and retain the carbons in the same position as they are when both pairs are touching before the circuit is closed. Any further movement of the clutch separates the carbons. Directly the current is switched off the stops, H, unlock the discs.

Incidental to the system is the great advantage that no shunt coil is necessary for the magnetic control as is the case when two or more arc lamps are run in series.

In the lamp described 9 mm. carbons are employed for a current of three amperes which, however, reduces the hours of burning of the lamp to 90, but the writer considers it inadvisable to use thicker carbons than this on account of the sacrifice of economy.

Care is taken that the enclosing globe should be sufficiently gas tight to prevent great diffusion of the gases as, should there be too much admittance of air into the arc chamber the ends of the carbons do not become so graphitised as they do when diffusion is kept within limits. This has an important bearing on the efficiency of enclosed lamps, as not only does it make the carbons consume faster but the graphitised end of the carbon reaches a higher temperature than the ungraphitised end, which increases the efficiency.

The lamp is being manufactured by the Reason Manufacturing Company, Limited.

NEW PATENTS, 1902.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London W.C., and at Liverpool, to whom all inquiries should be addressed.

8,629. "Improvements in or applicable to the trolley heads of electric cars." H. Craven and J. R. Garner. April 14th.

8,630. "Improved insulating lapping for electric wires." E. T. Whitelow. April 14th.

8,643. "Improvements in or connected with means for damping the oscillations of the hands or pointers of electrical measuring instruments or the like." F. H. Nalder and Nalder Bros. & Thompson, Limited. April 14th. (Complete.)

8,645. "An improved method of automatically regulating the flow of liquids gases, electricity, chemicals and powders." W. P. Miles. April 14th.

8,667. "An improvement in the method of regulating the pressure of alternating current dynamo-electric generators." Siemens Bros. & Co., Limited. Siemens & Halske, Aktien Gesellschaft, Germany.) April 14th. (Complete.

8,670. "Improvements in electric arc lamps." T. L. Carbone. April 14th. (Complete.)

8,717. "Improvements in or relating to electric lamps." W. Fairburn-Hart (The General Electric Company, United States.) April 15th. (Complete.)

8,748. "Improved means for securing and adjusting the active laminated rings of electrical machines and motors in their frames." Siemens Bros. and Co., Limited. (Siemens & Halske, Aktien-Gesellschaft, Germany.) April 15th. (Complete.)

8,784. "Improvements relating to rail bonds or connections for electric railways." H. H. Lake. (E. G. Thomas, United States.) April 15th. (Complete.)

8,788. "Improvements in alternate current measuring and indicating instruments." L. Andrews. April 15th.

8,789. "Improvements in and relating to electrical distributing systems." L. Andrews. April 15th.

8,794. "Mechanism for recessing trolley wires." W. A. McCallum. April 15th. (Complete.)

8,796. "Improvements in or in connection with electric controlling devices." H. C. Froelich and E. P. Baird. April 15th.

8,809. "Improvements in circuit controllers." J. J. Ghagan and E. J. Griswold. April 15th. (Complete.)

8,824. "Improved means for suspending overhead wires for electric traction." T. Gregson. April 16th.

8,858. "A process and device for producing effective and reliable electrical ignitions of explosive substances." H. W. Hellmann. April 16th.

8,863. "Improved apparatus for the application of the electric light to medical purposes." A. Brook. April 16th.

8,866. "Improvements in wireless electrical communications." H. Brooker, W. H. Goss and J. Lea. April 16th.

8,872. "Improvements in switches for electric lighting." S. Bach. April 16th. (Complete.)

8,878. "Improvements in protecting devices for overhead electric traction systems." W. Rutherford. (J. Roberts, Natal.) April 16th.

8,884. "Improvements in electric arc lamps." G. W. Johnson. (Volthom Elektrizitäts Gesellschaft, Aktien Gesellschaft, Germany. April 16th.

8,892. "Improvements in, and relating to, electrically-wound clocks." H. H. Lake. (Aktiebolaget Svenska Elektriska Urfabriken, Sweden.)

8,948. "Improvements in or relating to switch reversing devices on motor cars or other vehicles." G. Seitz. April 17th.

8,947. "Improvements in electric arc lamps." L. Wirtz. April 17th.

8,969. "Improvements in dynamo-electric generators." H. J. Haddan. (H. L. Peck, United States.) April 17th. (Complete.)

9,040. "Improvements in and relating to the manufacture of electric conductrrs." S. G. Brown. April 18th.

9,044. "Improvements in and relating to telephonic apparatus." S. G. Brown. April 18th.

9,049. "Improvements in air valves for radiators." F. W. Leuthesser. (Date applied for under Patents Act, 1901, December 2nd, 1901, being date of application in United States.) April 18th. (Complete.)

9,057. "An improved method of winding for electric machines and appliances." R. Rouge. April 18th.

9,062. "Improvements in connection with electric arc lamps." F. Gubino and J. Auerbach. April 18th.

9,068. "Improvements in electric tram and railways on a sectional conductor system." J. Leighton and R. Hacking. April 18th.

9,074. "Improvements in series resistances for Nernst lamps." Nernst Electric Light Limited. April 19th.

9,077. "An automatic life-guard for the electric tramcars." W. Jackson. April 19th.

9,135. "Improvements in coin-freed electric meters." The British Thomson-Houston Company, Limited, and F. Holden. April 19th.

9,143. "Improvements in the production of secondary electric currents." R. Grisson. April 19th.